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## CONTENTS—JULY, 1954

SYMPOSIUM ON SPINE AND SPINAL CORD

Tumors of the Foramen Magnum........................................................
*J. Grafton Love, M.D., F.A.C.S., F.I.C.S. (Hon.) Emil P. Thelen, M.D., and Henry W. Dodge Jr., M.D., Rochester, Minnesota*

Focal Spinal Arachnoiditis Complicating Spinal Anesthesia..........................
*Jonathan M. Williams, M.D., F.A.C.S., Washington, D. C.*

Spinal Cord Reflexes........................................................................
*Karl-Erik Hagbarth, M.D., D.A.B., Stockholm, Sweden*

Spinal Echinococcosis ... 35
*Feyyaz Berkay, M.D., F.I.C.S., Istanbul, Turkey*

Physiologic Mechanisms of Spinal Shock ... 44
*George M. Austin, M.D., and Grayson P. McCouch, M.D., D.A.B., Philadelphia, Pennsylvania*

Relief of Spasticity in Paraplegia (Abstract and Discussion) ... 53
*Irving S. Cooper, M.D., New York City, New York*

Surgical Treatment of Congenital Spinal Disorders (Abstract and Discussion) ... 59
*Donald Matson, M.D., F.A.C.S., Boston, Massachusetts*

Bladder Disturbances and the Management of Patients With Injury to the Spinal Cord (Abstract and Discussion) ... 61
*Ernest Bors, M.D., Long Beach, California*

Evaluation of Skeletal Traction in the Treatment of Cervical Spine Injuries (Abstract and Discussion) ... 63
*William Gayle Crutchfield, M.D., Charlottesville, Virginia*

xperimental Regeneration in the Spinal Cord (Abstract and Discussion) ... 66
*W. W. Chambers, Ph.D., Philadelphia, Pennsylvania*

THER ORIGINAL ARTICLES

Tumors of the Brain and Spinal Cord as They Concern the General Surgeon ... 68
*Hendrik J. Svien, M.D., F.A.C.S., and Andrew L. Karavitis, M.D., Rochester, Minnesota*

Transabdominal Anterior Discographic Examination ... 76
*John I. Perl, M.D., F.A.C.S., Chicago, Illinois*

A New Method for Anesthetizing the Inferior Alveolar Nerve ... 85
*Ziya Camal B. Aksoy, M.D.†, D.S., F.I.C.S.*

Spontaneous Intracerebral Hematoma ... 89
*William R. Chambers, M.D., William W. Moore, M.D., and Exum Walker, M.D., Atlanta, Georgia*

Venous Angioma: A Cause of Cerebral Palsy ... 94
*Samuel Rosner, M.D., F.I.C.S., New York City, New York*

Cerebral Venous Angioma Treated by Electrocautery ... 98
*Samuel Rosner, M.D., F.I.C.S., New York City, New York*

Diastematomyelia ... 100
*Edward Martin Gates, M.D., F.A.C.S., and James A. Morton, M.D., F.A.C.R., Pontiac, Michigan*

EDITORIAL

Section on Neurosurgery: A New Field of Cooperative Endeavor ... 103
*James Winston Watts, M.D., F.A.C.S., F.I.C.S.*

NEW BOOKS ... 105

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†Deceased

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Vol. XXII JULY, 1954 No. 1

# *Symposium*

## Tumors of the Foramen Magnum

J. GRAFTON LOVE, M.D., F.A.C.S., F.I.C.S. (Hon.)
EMIL P. THELEN, M.D., AND HENRY W. DODGE JR., M.D.
ROCHESTER, MINNESOTA

SINCE tumors of the foramen magnum are relatively uncommon and since headache and cervical pain (early and often initial symptoms of such tumors) are such frequent complaints of patients in general, these lesions are likely to go unrecognized until serious and often tragic neurologic sequelae have occurred.

A large number of neoplasms occurring at this level of the neuraxis are either frankly benign or of such low grade malignancy that the long-term prognosis after total removal is favorable. The prognosis for highly malignant tumors of this region varies little, of course, from that of such tumors located elsewhere in the body. However, it seems likely that the eventual surgical result can be greatly bettered in the case of benign and slowly growing malignant growths occurring at the foramen magnum if the diagnostic team manifests early suspicion and the neurosurgeon early endeavor. Also, fortified surgical optimism is a valuable adjunct.

The serious nature of tumors of the foramen magnum is attested to by the fact that many of them in the past have been recorded from postmortem examination. However, the singular experience of watching a patient progress from quadriplegia and Cheyne-Stokes respiration to eventual complete recovery following surgical removal of a meningioma of this region makes even the most dubious regard headache (particularly when suboccipital), cervical pain, peculiar peripheral weakness and paresthesias with a more critical and appraising eye.

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From the Section of Neurologic Surgery, the Mayo Clinic (Drs. Love and Dodge) and the Mayo Foundation (Dr. Thelen, Fellow in Neurosurgery).

Read at the Eighteenth Annual Congress of the United States and Canadian Sections, International College of Surgeons, New York, Sept. 13-17, 1953.

The pathologic material in this paper was presented as part of Dr. Thelen's thesis. The material has been reviewed by Dr. J. W. Kernohan of the Section of Pathologic Anatomy.

*Submitted for publication Oct. 19, 1953.*

The purpose of this paper is to present observations made in 74 cases of tumor of the foramen magnum encountered at the Mayo Clinic through December 1952, among approximately 5,400 tumors of the brain and 1,200 tumors of the spinal cord. Figure 1 portrays the general appearance of the region under consideration. Details may be obtained from any standard textbook of anatomy.

*Prior Observations.*—In 1888, Osler reported a glioma extending to the foramen magnum. Other early reports were made by Sokoloff and by Spiller. The latter, in 1907, reported a tumor that extended from the fourth ventricle to the level of the sixth cervical vertebra.

Significant contributions to the problem were made by Abrahamson and Grossman from 1921 to 1923, Frazier and Spiller in 1922, Bailey in 1924, Elsberg in 1925, and Tilney and Elsberg in 1926.

In 1928 Cushing and Bailey reported 5 cases in which a vascular tumor passed through the foramen magnum. Elsberg and Strauss reviewed the data on 6 cases in which an extramedullary tumor projected into the posterior cranial fossa, and observed that in only 7 of 185 cases of tumor of the spinal cord did the growth lie both in the upper vertebral canal and in the posterior fossa. In 1932 Cushing published his extensive work on intracranial tumors, with statistics.

Symonds and Meadows in 1937 added 7 cases of tumor of the foramen magnum, in 1 of which the tumor was an aneurysm of the vertebral artery. Similarly, a vertebral aneurysm was reported by Yaskin and Alpers in 1944. In 1938 Gardner and his co-workers suggested that further study of tumors in the region of the foramen magnum would be necessary to formulate a basis for recognition of these new growths.

Cushing and Eisenhardt then published a communication in which they differentiated supraforaminal (craniospinal) from subforaminal (spinocranial) tumors. They also cited Bogorodinsky, who analyzed 1 case of his own and 22 cases from the literature under the name of craniospinal tumor.

Subsequently, in 1941, Love and Adson reported 23 cases of a lesion at the foramen magnum, and other cases were reported by List in 1943, Bennett and Fortes in 1945 and Grant in 1948. The diagnostic problem of lesions at this level in the neuraxis was reviewed in 1950 by Abbott and by Piehl, Reese and Steelman.

*Symptoms.*—In our group of 74 cases there were 1 aneurysm of the vertebral artery and 73 neoplasms. We have been careful to include only new growths arising in, or immediately above or immediately below and extending through, the foramen magnum.

The longest duration of symptoms was more than thirteen years, and at operation in that case the symptoms were shown to be due to a meningioma. The average duration of symptoms was somewhat more than twenty-eight months. There were 39 male and 35 female patients in the series. The ages varied from 2 to 70 years, the most common ages being in the range of 31 to 50.

Pain as an initial complaint was common. It was usually felt in the postcervical or suboccipital region, but in a few cases it was in the lumbar region and the lower extremities. Occasionally pain affected an upper extremity, and rarely pain and weakness of an extremity occurred simultaneously. An increase in discomfort was characteristically caused by attempted movements of the neck and head, and patients tended to have protective limitation of motion of the neck.

An equally common initial complaint was headache, which became increasingly severe. The headaches were predominantly occipital, but frequently were described as extending forward to the parietal and frontal areas.

Weakness of an extremity was another initial complaint. This was experienced more commonly in an upper than in a lower extremity. Other primary symptoms were nausea and vomiting, peripheral paresthesias, double vision, recurrent attacks of

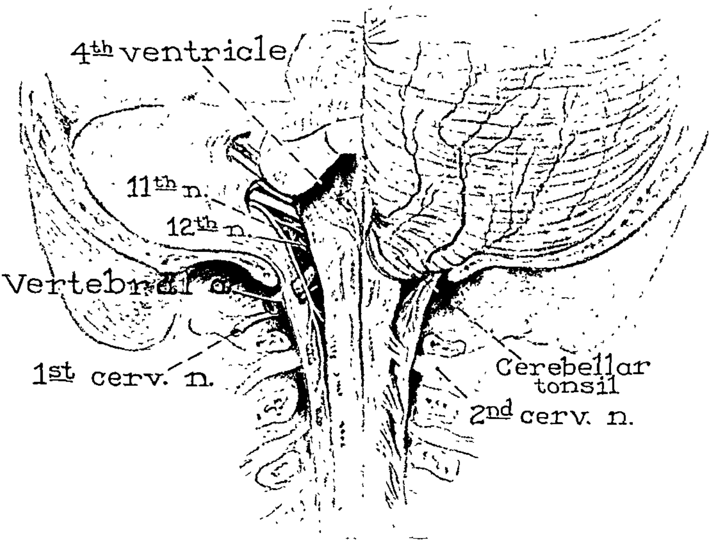

Fig. 1.—Important anatomic structures in the region of the foramen magnum.

dizziness, unsteady gait, hoarseness, and difficulty in swallowing and phonation. Several patients described a "profound weakness" (fatigue), which prevented them from doing anything.

An unusual and difficult symptom to evaluate was the early occurrence of low back pain and severe unilateral or bilateral sciatica in 2 cases. The association of low back and sciatic pain with lesions of the cervical cord has been noted by Camp.

Paresthesias (numbness, tingling, burning, itching) were present at some time in 45 cases.

There were no motor or sensory symptoms in 15 cases, while combined motor and sensory difficulties were present in 36 of the 74 cases. Sensory but no motor symptoms were recorded in 7 cases, and motor but no sensory abnormalities were observed in 9. Six persons described a feeling of generalized weakness without alteration of sensation, and 1 described profound weakness of all extremities, but the neurologist was unable objectively to show sensory deficit. In 2 of the 7 patients complaining of generalized weakness the records indicated that the attacks of weakness were transitory but repetitious.

In 49 cases there were histories of progressive motor weakness, although it was difficult to establish any particular pattern of loss of motor function. Case 1 is a good example of the problem presented in the diagnosis of these tumors, and well demonstrates the need for suspecting tumors when confronted by progressive lesions near the foramen magnum.

## REPORT OF CASES

CASE 1.—A 43-year-old white married woman, who was first examined at the Mayo Clinic in June 1951, had a primary complaint of swelling and burning of the hands and a feeling of weakness. Over the previous eight years she had noticed increasing pain and tingling in her hands, with a tendency for the hands to "go to sleep." In the two or three years preceding her visit to the clinic she had noticed increased subjective weakness of the hands and swelling of the fingers, and over the preceding twelve months she had felt a "constricting band" around the abdomen.

The results of general physical examination were within normal limits. Routine laboratory studies, including a blood count, urinalysis and blood chemical determinations, gave normal results. The blood sedimentation rate (Westergren method) was 53 mm. in one hour, and the blood serologic reaction for syphilis was negative. Routine roentgenograms of the cervical portion of the spinal column, chest and skull were reported as not disclosing any abnormality. Neurologic examination revealed only slightly increased deep tendon reflexes. Because of the failure to discover definite neurologic or general physical abnormalities, medical therapy was prescribed and the patient was advised, if her complaints persisted or became worse, to return for reexamination.

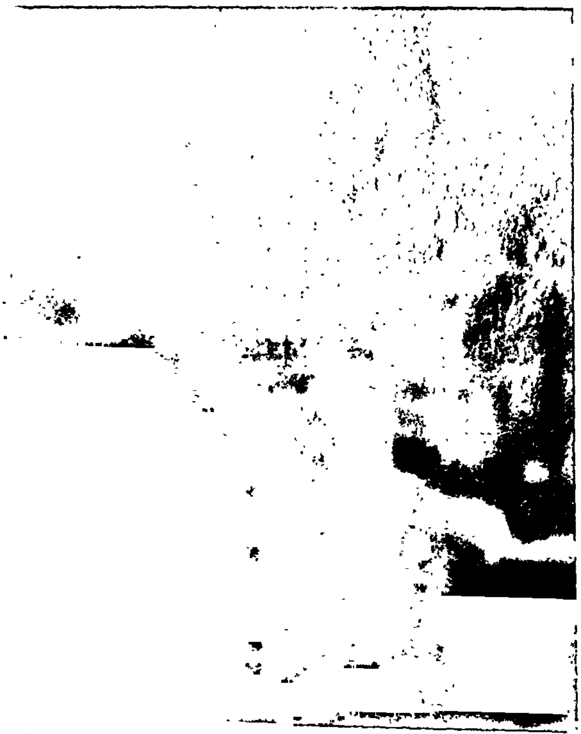

Fig. 2.—Myelogram showing block at the level of the first cervical vertebra and outlining the inferior portion of the meningioma described in Case 1. At times herniation of the cerebellar tonsils gives just such a picture and may be confused with a tumor at this level.

In October 1952, approximately sixteen months later, the patient was readmitted to the clinic seriously ill. She was having respiratory difficulty. The cranial nerves seemed intact on neurologic examination; the right arm and leg were paralyzed, and the left arm and leg were very weak. Signs related to the arms and legs indicated bilateral involvement of the pyramidal tracts. Superficial sensation was greatly impaired from the region of the second cervical dermatome down, although in the legs the sensation was somewhat better. Vibratory sense was impaired in the shoulders and sternum but seemed intact in the legs. Joint sense was recorded as normal except in the right hand.

Because of the patient's rapidly worsening condition, she was placed in a chest respirator. During the preliminary investigation her consciousness was intact and there was little evidence of increased intracranial pressure. She was able to state that a neurosurgeon in her home community had recently taken a myelogram, which was considered not to have shown any abnormality.

Because of the suspicion of a lesion in the high cervical region or in the foramen magnum, another myelogram was taken. This revealed a filling defect in the column of contrast medium (pantopaque) at the level of the first cervical vertebra (Fig. 2), and immediate operation was advised. Tracheotomy was performed as a preliminary measure. Then combined suboccipital craniectomy and cervical laminectomy were performed and a meningioma of the foramen magnum removed. This tumor was on the left anterolateral aspect of the cord and medulla.

After the operation the patient made a rapid recovery, and when dismissed, on Nov. 4, 1952, she was able to walk out of the hospital. She was seen again after dismissal, and her improvement was continuing.

*Neurologic Data.* — In 38 cases there were no objective sensory disturbances, and 4 additional patients could not be adequately examined for these changes. Three patients complained of loss of pain and temperature sensation on a part of one side of the body and loss of touch sensation on a part of the opposite side, yet none exhibited the typical features of the Brown-Sequard syndrome. In 7 cases the area of loss of pain and temperature sensation coincided with the deficit to touch. In 2 cases the loss was on the same side but in different areas.

An objective loss of pain sensation was present in 32 cases. Loss of temperature appreciation paralleled the loss of pain except in 3 instances. In these there was a definite loss of the sense of pain, but temperature appreciation was normal.

Tactile sensation was definitely absent in 17 cases. Loss of vibratory sense was recorded in 24 cases, and a decided reduction or loss of joint sense was noted in 19 cases. In general, loss of joint awareness and vibratory sense paralleled the loss of tactile discrimination.

Astereognosis was reported in 18 cases, in 12 of which it was bilateral. Numerous authors have criticized the use of the term "astereognosis" whenever there is an alteration of sensation. In our group of patients, sensation was disturbed in 16 of the 18 cases.

Coordination was impaired in 56 cases, and the Romberg sign was positive in 28 cases. Disturbance of gait occurred in 63 cases, in 12 of which the patients were unable to walk.

Impairment of strength was encountered in 49 persons, 6 of whom exhibited hemiparesis. There was involvement of all four extremities in 17 cases. The upper extremities alone were involved in 5 cases, in 1 of which the weakness was confined to the shoulder girdle. In 4 cases both upper extremities were affected. In 3 cases there was weakness of both legs, and in 1 case there was involvement of only one leg. In 7 other cases no weakness was reported except that due to dysfunction of the cranial nerves. In 3 instances the strength could not be adequately tested.

Muscular atrophy was recorded in 17 cases. In 12 of these there was atrophy of the small muscles of the hands, and in 7 instances this was bilateral. In the remaining cases the atrophy was located in the shoulder or arm muscles. Fibrillation occurred in 11 cases, in 3 of which it was noticed in the tongue, and in the remainder of which it occurred in the upper extremities.

Reflex changes were present in 64 cases. An increase in the tendon reflexes of one or both sides was the common observation. In 8 cases the corneal reflex was diminished or absent, being affected bilaterally in 6. There was involvement of the palate or pharyngeal reflexes in 10 cases, in 7 of which it was bilateral. There was involvement of one or more of the cranial nerves in 46 cases.

Papilledema was recorded in 37 cases. It was not noted in cases of the spinocranial tumor, but it has been observed in cases of tumor of the cervical cord.[17] In the cases in which blindness was present there was a high degree of choke, with evidence of optic atrophy. In 18 cases there was paresis of one or more of the extrinsic muscles of the eye. In the few patients with changes in the visual fields, the defect usually could be accounted for on the basis of hydrocephalus of the third ventricle or a high degree of choke.

There was involvement of the region supplied by the trigeminal nerve, as evidenced by diminished corneal reflexes or loss of facial sensation, in 15 cases; in 2 additional cases there was also weakness of the muscles of mastication. There was involvement of the facial nerve in 9 cases, in 6 of which it was of the peripheral type. Hearing was diminished in 8 cases. There was evidence of involvement of the glossopharyngeal and vagus nerves in 15 cases. The spinal accessory nerve was affected in 14 cases, the condition being bilateral in 9. The hypoglossal nerve was involved in 10 cases. Although Horner's syndrome in complete form was not present in any of these cases, there was evidence of impairment of the sympathetic nervous system. In 10 cases miosis was noted. In 1 case there was absence of sweating on one side of the face. Nystagmus was present in 41 cases.

Electroencephalographic study has not proved of much aid in our hands in the diagnosis of tumors at this level of the neuraxis, except to arouse further sus-

Fig. 3.—Degenerating cystic neurofibroma measuring 6 by 3 by 2 cm. and weighing 7.8 Gm., which extended from the third cervical level up to and through the foramen magnum. This tumor was removed from a 37-year-old white man who had had unexplained early morning cervical pain for two years before suddenly experiencing peculiar paresthesias and weakness of the arms and legs two weeks prior to admission to the clinic.

picion in the occasional case of a lesion that is situated in the posterior fossa and that may be associated with bilateral occipital or posterior parietal dysrhythmias.

Until recently electromyographic methods have not been employed, but it does seem likely that, if judiciously applied, this mechanical test might at times give valuable clues as to the disease process comprising the upper part of the cervical portion of the spinal cord. This may have been true in the following case:

Case 2.—A 50-year-old white married physician, who was first examined at the Mayo Clinic in January 1950, had a chief complaint of muscle spasms of the neck of one year's duration. He stated that approximately eleven months before admission he had been straining at stool and had experienced a sharp pain over the lower posterior portion of his neck. This pain was intermittent, but became more frequent and did not respond to any particular treatment. Over the next several months the pain was accompanied by spasm of the cervical muscles and soreness, and the patient became increasingly nervous and experienced considerable fatigue. He was unable to obtain relief from spasm of the cervical muscles and the cervical pain by any of the usual methods. It had been intimated strongly to him elsewhere that his pain was on a functional basis.

The results of general physical examination, laboratory tests and roentgenographic examination of the skull, the cervical portion of the spinal column and the chest were all within normal limits. The blood serologic reaction for syphilis was negative. Urinalysis gave negative results. The observations on careful neurologic examination were within normal limits except for slight horizontal nystagmus on lateral gaze and occasional double vision on downward gaze. Electroencephalographic investigation, examination of the fundus and studies of the visual fields were all interpreted as giving results within normal limits.

Because of the persistent suboccipital and posterior cervical discomfort and the slight nystagmus with occasional diplopia, a lesion of the posterior fossa or the foramen magnum was suspected. Examination of the spinal fluid, which was made without a Queckenstedt test, revealed a protein content of 75 mg. per hundred cubic centimeters and a lymphocyte count of 2 per cubic millimeter. The gold sol curve was normal, and the Kolmer reaction for syphilis was negative.

At exploration carried out on February 1, a large Grade 2 astrocytoma was encountered. This passed from the posterior fossa down through the foramen magnum to the upper part of the cervical portion of the spinal cord.

After the operation the patient made a satisfactory recovery. When he was last examined, in June 1953, careful neurologic investigation failed to reveal evidence of recurrence.

*Roentgenologic Aspects.* — Routine roentgenographic examination of the skull and the cervical portion of the spinal column was of aid in 32 of the 74 cases. In 2 cases neither the roentgenograms nor the reports on them were available. The most common abnormalities, listed in descending order of frequency with which they were encountered on routine roentgenographic survey, are given in Table 1.

At the Mayo Clinic, routine roentgenograms of the skull include postero-anterior, stereoscopic, lateral and Towne views. Anteroposterior, lateral and usually three-quarter views of the cervical portion of the spinal column also are obtained when a cervical lesion or a tumor at the foramen magnum is suspected.

Contrast radiologic studies were done in 14 cases. A pneumoencephalogram made in 1 case revealed an anterior displacement of the aqueduct. Ventriculograms were taken in 7 cases as a diagnostic procedure; in 6 of these cases a diagnosis of a lesion in the posterior fossa was made, while in the other, internal hydrocephalus was the only diagnosis that could be made. Six patients underwent myelographic studies, 2 with lipiodol and 4 with pantopaque. In 1 case myelographic study gave negative results, while in the others it revealed an obstruction at the appropriate site. One patient had had contrast studies elsewhere, but the results were not available to us.

*Cerebrospinal Fluid.*—The cerebrospinal fluid was examined in 27 cases. Complete block was present in 6 cases and a partial block in 4 in which the Queckenstedt test was made. Often, when we suspect a neoplasm in the posterior cranial fossa or at the foramen magnum, if there is no edema of the optic discs we do a diagnostic lumbar puncture to obtain fluid for protein determination without doing a Queckenstedt test.

The protein content of the fluid was increased in 22 cases. In 12 cases it was more than 100 mg. per hundred cubic centimeters, ranging between 110 and 4,000 mg., while in 4 cases it was between 70 and 90 mg. In the remaining cases the protein level was 60 mg. or less, being 20 mg. in 2 cases.

In 3 cases the neurologic symptoms and signs were greatly increased after spinal puncture. In 2 cases an exacerbation of symptoms followed a spinal puncture at home.

*Surgical Aspects.*—To the best of our knowledge, curing a patient harboring a tumor of the nervous system is best effected by complete removal of that tumor, benign or malignant. Surgical intervention may be complemented at times by high voltage roentgen or radium therapy. Occasionally it is deemed necessary to resort to primary irradiation without surgical intervention, in the hope of palliation. The benefit of this is often only temporary.

The removal of a tumor originating within the posterior cranial fossa and extending downward through the foramen magnum into the cervical spinal canal (craniospinal), or a tumor arising primarily in the cervical spinal canal and growing upward (Fig. 3) through the foramen magnum (spinocranial) is ordinarily accomplished by means of a combined cervico-occipital operation, that is, a suboccipital craniectomy is performed and extended to include an upper cervical laminectomy.

Such an operation is best performed with the patient in the upright position, through a midline incision extending from a point 3.5 cm. above the external occipital protuberance downward across the tips of the bifid cervical spinous processes. The length of the downward extension depends on the extent of the intraspinal portion of the tumor, and this often cannot be determined until the lower portion of the neoplasm has been exposed. Whenever possible, laminectomy should be of the unilateral or hemilaminectomy type, so that the normal stability and flexibility of the cervical part of the spinal column may be preserved. At times, because of the size or position of the tumor, it is essential to remove both laminae of the cervical vertebrae to secure adequate exposure. In any event, reflection of the muscles should be subperiosteal, the articulating facets should be preserved, and accurate suturing of the different anatomic layers should be carefully attended to in closure of the wound. Hemostasis must be meticulous, and observance of the strictest aseptic technic is essential (Fig. 4).

With patients evidencing weakness of the pharyngeal and laryngeal muscles we are relucant to use general anesthesia and have found combined sedation and local infiltration of the operative site extremely

TABLE 1. — *Roentgenographic Data Associated with Tumors of the Foramen Magnum and Listed in Descending Order of Frequency of Occurrence in 74 Cases*

1. Evidence of increased intracranial pressure
    a. Erosion of clinoid processes
    b. Separation of sutures
    c. Increased convolutional markings
2. Widening of interpedicular spaces of the upper cervical vertebrae
3. Enlargement of the foramen magnum, with or without evidence of bony erosion
4. Calcification in or about the foramen magnum
5. Enlargement of an [illegible] vertebral foramen

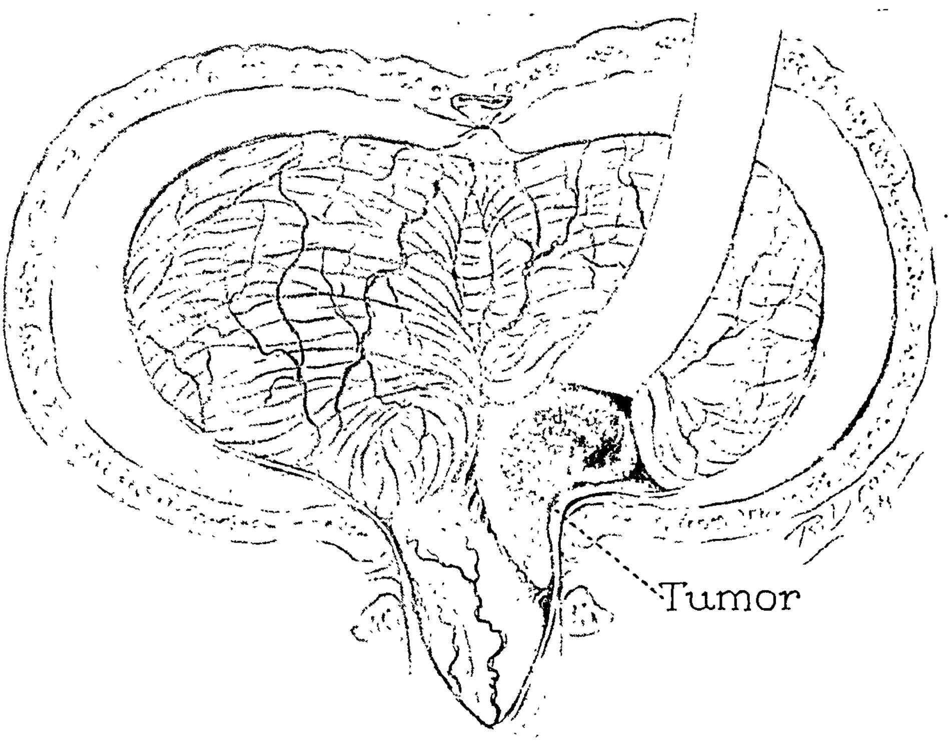

Fig. 4.—Surgical exposure of an endothelioma situated posterior to the upper cervical portion of the spinal cord and extending upward (spinocranial) through the foramen magnum.

useful and, in our opinion life-saving. The majority of patients in the past have been operated on with endotracheal open drop ether anesthesia. More recently, combined pentothal-nitrous oxide-oxygen-curare anesthesia has been used.

Surgically the greatest advance in the successful handling of patients with compressive lesions of the upper cervical part of the cord and the lower part of the brain stem seems to us to be the judicious use of preoperative or early postoperative tracheotomy to permit an unobstructed airway, better oxygenation of the blood, and better aspiration of accumulated secretion in those cases in which respiratory stimulus or muscle power is inadequate. In such cases, the use of antibiotics, oxygen therapy, blood replacement, and maintenance of fluid and electrolyte balance are, of course, routine.

From the standpoint of surgical extirpation, separation of tumors of the foramen magnum into "supraforaminal" and "subforaminal" types is chiefly of academic interest. Except for those intramedullary neoplasms and those situated anterior to the medulla and involving the basilar groove, the difficulties of surgical extirpation are about the same with respect to both the aforementioned classifications. Any operative procedure at this level involves grave danger, because of the proximity of so many vital centers in the medulla oblongata (Fig. 5).

The surgical mortality rate associated with tumors of the foramen magnum is likely to be high, for many cases are encountered by the neurosurgeon only when late signs of medullary encroachment are in evidence. Of the 74 patients in our series, 34 died during the postoperative period (at the Mayo Clinic any patient who dies after an operation while he is still hospitalized is considered statistically to represent a postoperative death, regardless of the time interval between surgical intervention and death).

Death most commonly was the result of respiratory failure. It was rarely caused by infection, uncontrolled hemorrhage or postoperative shock. The confusing surgical diagnostic problem that may be presented by tumors at this level, and which is well illustrated by Case 3, is undoubtedly the cause of late recognition and late surgical therapy in many instances.

CASE 3.—A 42-year-old white married woman, who was first examined at the Mayo Clinic in June 1950, presented the main complaints of double vision, nausea and vomiting, and cervical pain. A carefully taken history revealed that approximately six months earlier, after much strenuous activity, she had begun to have effortless vomiting. This persisted, and she gradually became weaker. Because of the persistent vomiting the diagnosis of gallbladder disease was made elsewhere and the gallbladder was removed, as well as the appendix.

In March 1950, during the hospitalization for this operation at another clinic, the patient began to notice some loss of visual acuity, and complained so much of pain in the neck and difficulty with the bowels that she was given a course of electroshock therapy. Three months prior to admission to the Mayo Clinic she had returned home and had begun to experience dizzy spells with double vision. The nausea and vomiting had continued, and the patient was considerably weakened. Because of her continuing complaints and her refusal to attempt to walk, she was given another shock treatment.

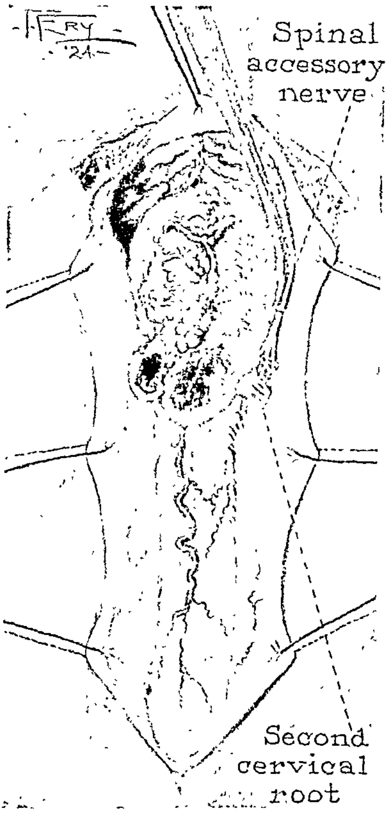

Fig. 5.—Surgical exposure of a chordoma within the foramen magnum that was causing marked compression and distortion of the medulla oblongata. (*Reproduced by permission from Adson, A. W.; Kernohan, J. W. and Woltman, H. W.: Cranial and Cervical Chordomas: a Clinical and Histologic Study, Arch. Neurol. & Psychiat. 33: 247-261 [Feb.] 1935*).

Since her complaints of posterior cervical pain, dizziness, vomiting and weakness were increasing, the patient was brought to the clinic. Neurologic examination revealed much splinting of the head and neck and grimacing when an attempt was made to move the head passively. There was palsy of the right external rectus, and the patient exhibited a bizarre gait, which was seemingly functional. She talked incessantly of multiple functional complaints. The roentgenographic appearance of the skull, the cervical part of the spinal column and the chest was within normal limits. There was edema of the right optic disc, of 1 diopter. The left optic nerve head was considered normal. Visual field studies showed a left inferior nasal and relative inferior altitudinal anopsia with central scotoma and an enlarged blind spot on the right—features characteristic of the syndrome of a left basofrontal lesion. The electroencephalographic patterns were in
tient was suspec
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ing the fourth ventricle. It was decided to explore the foramen magnum and the upper cervical part of the cord. At operation a large metastatic Grade 2 adenocarcinoma (hypernephroma type) was observed, extending from the right cerebellar lobe through the foramen magnum into the cervical part of the spinal cord. Convalescence from the operation was uneventful, and the patient was dismissed home on the ninth postoperative day.

*Pathologic Characteristics.* — As has been indicated, of the 74 lesions causing compression of the neuraxis at the foramen magnum, 73 were neoplasms and 1 was an aneurysm of the vertebral artery. The verified histologic diagnoses are given in Table 2. Nineteen of the lesions were of the spinocranial type, arising from below the foramen magnum and projecting cephalad through it, and 54 were of the craniospinal type, that is, the tumors originated cephalad to the foramen and projected down through it. The remaining case was that of the aneurysm of the vertebral artery.

It is of great importance and interest to note the large number of meningiomas and low-grade malignant lesions encountered (Table 2). There was excellent correlation between the type of tumor encountered and the duration of symptoms. The correlation between the age of patient and the type of lesion is shown in Table 2. Because of the benignancy or low-grade malignancy of many of these tumors, accurate, early diagnosis is imperative if better results are to be obtained.

## COMMENT

Critical evaluation of our 74 cases and review of those reported in the literature led us to conclude that no characteristic syndrome can be ascribed to operable tumors of the foramen magnum. When the patient comes for diagnosis and treatment

TABLE 2.—*Distribution of Cases of Tumor of the Foramen Magnum According to Age of Patient and Type of Tumor*

| Type of Tumor | Age, Years<br>0-10 | 11-20 | 21-30 | 31-40 | 41-50 | 51-60 | 61-70 | Total Cases |
|---|---|---|---|---|---|---|---|---|
| Meningioma | — | — | 2 | 4 | 11 | 2 | 2 | 21 |
| Astrocytoma | 4 | 2 | 4 | 1 | 3 | 2 | — | 16 |
| Ependymoma | 6 | 2 | 2 | 3 | 1 | — | — | 14 |
| Hemangioendothelioma | — | — | 1 | 1 | 2 | — | 1 | 5 |
| Medulloblastoma | 4 | — | — | — | — | — | — | 4 |
| Neurofibroma | — | 2 | — | 1 | — | — | — | 3 |
| Oligodendroglioma | — | 1 | — | — | 1 | — | — | 2 |
| Chordoma | 1 | — | — | — | — | 1 | — | 2 |
| Melanoepithelioma | — | — | — | 1 | — | 1 | — | 2 |
| Hemangioblastoma | — | — | — | 1 | — | — | — | 1 |
| Chondrosarcoma | — | — | — | — | — | 1 | — | 1 |
| Intramedullary glioma (type?) | — | — | — | — | — | — | 1 | 1 |
| Metastatic adenocarcinoma (hypernephroma type) | — | — | — | — | 1 | — | — | 1 |
| Aneurysm of vertebral artery | — | — | — | 1 | — | — | — | 1 |
| Total cases | 15 | 7 | 9 | 13 | 19 | 7 | 4 | 74 |

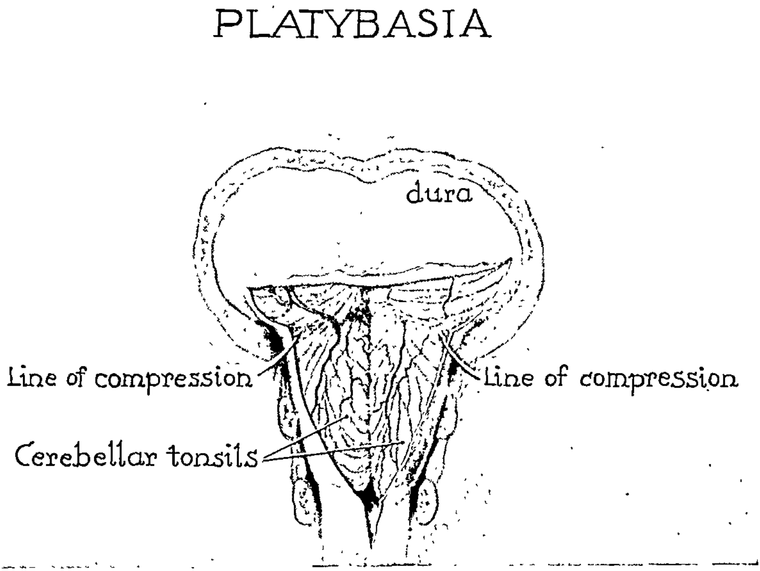


Fig. 6.—Platybasia which had produced symptoms similar to those of a tumor of the foramen magnum.

with the full-blown picture of compression by a tumor at the foramen magnum, his lesion is likely to be inoperable and incurable and to be seen first by the pathologist rather than by the surgeon.

It is evident, however, that despite the bizarre variation of symptoms and neurologic signs and the marked variation in the history of progression of the disorder, there are some factors that are relatively common and should raise the examiner's index of suspicion of a lesion at this level. Although many of the patients harboring these tumors, because of unusual symptoms and neurologic patterns are early suspected of functional difficulties, steady, relentless progression of the offending lesions is almost universal.

Pain in the upper cervical region, aggravated by motion of the neck, is most common. This, in association with suboccipital or occipital headache, occurred in the majority of our cases.

Weakness and paresthesias, usually involving the upper extremities primarily, were prominent in most cases, and most typically there was progression to involve the lower extremities. The area supplied by the second cervical nerve was affected in somewhat more than a fifth of the cases.

Vestibular and cerebellar dysfunction, as manifested by nystagmus, disturbances of gait and station and lack of co-ordination, occurred frequently. However, the pattern of motor loss was variable.

Muscular atrophy and fibrillation occurring in neural segments not directly involved by tumor suggest that some of the

Routine roentgenograms of the skull and the cervical part of the spinal column may not reveal abnormality in the region of the foramen magnum, and therefore additional views will be required. In our opinion the most information about this region may be obtained without resorting to contrast myelograms, through stereoscopic views of the base of the skull and through platybasia and atlas-axis roentgenograms. Occasionally, Stenvers views may show the first and second cervical vertebrae obliquely and to great advantage. For a specific area in this region, tomographic study may be worth while.

A further step in the diagnostic evalution may include spinal puncture and examination of the cerebrospinal fluid, with or without the Queckenstedt maneuver. In those cases in which there is even minimal evidence of respiratory difficulty or the slightest suspicion of increased intracranial pressure (even in the absence of choking of the optic discs), the Queckenstedt test is not performed. The pneumoencephalographic method is uncommonly used by us for suspected lesions in the region of the posterior fossa or the foramen magnum. If the protein content of the spinal fluid is 100 mg. or more per hundred cubic centimeters and if there is a suggestive progressive history, it is our opinion that direct surgical exploration is indicated. The presence of partial or complete block of the spinal fluid pathways makes the diagnosis of tumor more likely. We are convinced that it is hazardous to do a cisternal puncture when the patient is considered to have a lesion about the foramen magnum.

A further adjunct to the diagnosis is the contrast myelogram, taken with either pantopaque (ethyliodophenylundecylate) or lipiodal (iodized poppy seed oil). Some criticism has been directed toward the use of iodized oil in the region of the upper cervical part of the spinal cord because of the danger of passage of some globules of oil into the basal cisternae of the head. In our opinion, it should be used if the examining team considers a contrast myelogram necessary for accurate diagnosis.

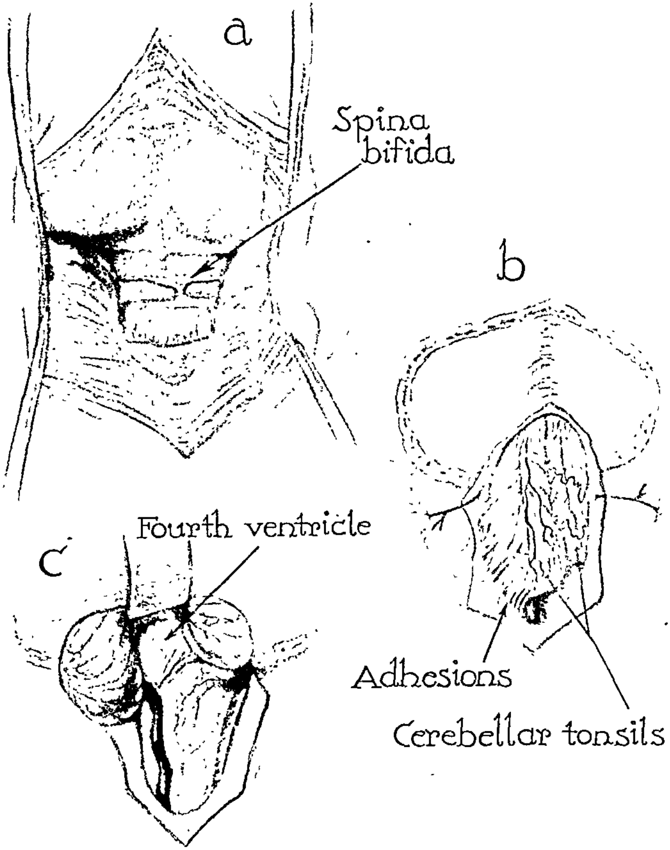


Fig. 7.—Congenital anomalies at foramen magnum may give rise to symptoms suggestive of a tumor.

It is not uncommon for the tumor to be localized clinically several segments below its actual site, and it would be unfortunate to laminectomize the cervical part of the spinal column without reward, only at a later date to recognize and r mor of the foramen magnum. Vertebral angiographic study can be employed as an alternate closed method of diagnosis.

Occasionally, when all examinations and tests have failed to disclose any positive evidence of a tumor and when all that remains is the diagnostic team's suspicion, direct exploration should be carried out provided the suspicion is strong enough. The patient and his relatives must first, however, be thoroughly acquainted with the advantages and disadvantages and with the comparative risks. Under such circumstances, the chance that exploration will disclose the absence of a tumor is preferable to the chance that ravages of a missed expanding lesion may be allowed to progress. Small anterior foraminal or basilar groove tumors may present just such a perplexing problem. Uncovering a degenerative lesion has little effect on the ultimate course except for the immediate surgical morbidity. Uncovering a tumor subject to palliation or cure may have a pronounced effect on the subsequent course.

## SUMMARY

The authors present the Mayo Clinic series of tumors of the foramen magnum encountered through December 1952. In this group are 1 aneurysm of the vertebral artery and 73 neoplasms. The pertinent literature is reviewed.

On the basis of their experience the authors are convinced that there is no typical syndrome for the accurate clinical diagnosis of these lesions. The most frequently occurring and significant symptoms and neurologic signs are reviewed. [illegible] afforded by thorough roentgen[illegible] spinal fluid examination [illegible] investigation [illegible]

[illegible]

ing of cervical and suboccipital pain, peculiar peripheral paresthesias and weakness in cases in which the history indicates that the difficulty is progressive.

### DISCUSSION BY DR. BYRON STOOKEY, NEW YORK

Dr. Stookey: The clinical signs indicative of an extramedullary tumor at the level of the foramen magnum depend on the precise origin in relation to the spinal neuraxis, on whether the tumor is ventral, lateral or dorsal, and on the exact level of origin. To gain any concept of the neurologic signs the relation of the growth to the various pathways and emerging nerves is essential in developing a syndrome. Of importance also is the nature of the neoplasm, whether soft or hard, slow or rapid in its development.

With the wealth of material in Dr. Love's paper, I hope he will subdivide these neoplasms into extramedullary and intramedullary and make for each group a clinical study of the symptoms and signs, since only by maintaining sharply defined pathologic entities can clinical signs of their presence be determined and early recognition of the symptoms be made. As has been pointed out by Dr. Love, early recognition is essential if successful removal is to be accomplished.

I note that there were 21 meningiomas and 3 neurofibromas. Thus, apparently one-third of all growths were extramedullary neoplasms. These should lend themselves to a clinical study of great diagnostic value. There are approximately twenty relatively common infiltrating tumors, namely the astrocytomas and medulloblastomas. Fourteen ependymomas are described. I presume that these arose in the fourth ventricle and extended into the cervical region and perhaps might therefore be studied profitably as a separate group.

The primary value and interest in these cases is inherent not only in the technical surgical problems they present in relation to the medulla and its vital centers, but in the diagnostic problem, so that early diagnosis can be made and surgical intervention accomplished while the growth still can be removed with minimal danger to the patient.

Surprise has been manifested that cranial nerve [illegible] are infrequent; yet these do occur and, in my experience, only when the [illegible] is ventral or ventrolateral in relation [illegible] most commonly involving [illegible] cranial nerves. The eleventh nerve is most frequently involved, since it takes a lateral course and extends over three or four segments within the cervical canal. Weakness on complete elevation of the arm is the most most characteristic sign, the arm being only partially elevated and not to a complete right angle. This weakness may easily be overlooked unless this sign is borne in mind.

In considering the signs produced by extramedullary tumors in this region, it is well to recall that actually the uppermost segments of the spinal cord and that part of the central axis within the foramen magnum lies actually in a large basal cistern surrounded by a large amount of spinal fluid, within whose confines considerable growth may take place without compromising the neural structures, either the cranial nerves nor the long fiber tracts of the neuraxis. Consequently, tumors in the region of the foramen magnum may be relatively silent until they have attained considerable size, sufficient to cause pressure upon either the neuraxis or the cervical or cranial nerves. Infrequency of signs referrable to the cranial nerves is due not only to the relative size of the cisterna magna but to the relative infrequency of tumors primarily ventrally placed.

When a tumor is ventrally placed, pressure may be exerted upon the ventral spinal artery and cause signs that may be and have been confusing, namely, atrophy of the muscles of the upper extremity and hand whose ventral roots are not compressed and arise a number of segments lower. It seems likely that compression of the anterior spinal artery may interfere with the blood supply to the ventral horn cells a few segments lower than the point of pressure and consequently give rise to atrophy in segments distal to the point of pressure. It is to be remembered that the anterior spinal artery is formed by two branches from the vertebral artery on the ventral surface of the medulla, from which it receives its major blood supply, and descends along the ventral aspect of the spinal cord. Consequently, in the high cervical region it constitutes the main arterial supply to the ventral part of the cervical cord. Interference with its circulation would deprive the ventral horn cells of their blood supply; hence the atrophy in lower segments. Recognition of the possibility of this mechanism is important, since focal atrophy in the lower segments may be interpreted as indicative of a lesion a number of segments lower.

I am glad that Dr. Love does not use the term astereognosis when there is disturbance of primary sensation, for only confusion can result from so doing. When primary sensation is implicated one cannot use the term astereognosis, and in tumors of this region pressure upon the dorsal column interferes with primary sensation and consequently the term astereognosis should not be used.

From a surgical standpoint, whenever possible the growth should be removed by Alfred Taylor's hemilaminectomy, since this best maintains the stability of this vital area in the vertebral column. The largest cervical cord tumor I have ever resected was removed through a hemilaminectomy without damage to the spinal cord. This approach is particularly favorable for a tumor ventrally placed. If the exposure is made through a hemilaminectomy and it is found that additional space is required, it is easy to enlarge the opening at the precise area needed and thus to maintain as much of the normal structure of the neck as possible, which cannot be done satisfactorily by a complete bilateral laminectomy.

Because of the probability of respiratory difficulty, endotracheal anesthesia is desirable in many instances. The upright posture and local anesthesia I have found to be of great value, not only in facilitating respiration but in diminishing bleeding.

Dr. Love and his co-workers are to be congratulated on their accomplishments in this field, where it is obvious that they have combined their great technical skill with excellent judgment.

### CLOSING REMARKS BY DR. LOVE

DR. LOVE: Apparently, the question of the importance of the second cervical nerve in the diagnosis of tumors of the foramen magnum was not emphasized as much as it should have been. Tumors arising high in the cervical region and growing upward through the foramen magnum and tumors growing downward through the foramen magnum into the upper cervical canal are very likely to press on and irritate the second cervical nerve.

As was indicated in the presentation, one of the chief symptoms, and one of the symptoms most commonly present in the series of cases reported, was pain in the suboccipital area on the side from which the tumor had taken its origin. It is important to do an unusually careful neurologic e[illegible]ation patients suspected of having [illegible] of

# Focal Spinal Arachnoiditis Complicating Spinal Anesthesia

JONATHAN M. WILLIAMS, M.D., F.A.C.S.
WASHINGTON, D. C.

Association, 12 cases of neurologic lesions following spinal anesthesia. (Prior to this, in 1945, Kennedy had anticipated himself in reporting 3 cases.[7]) This paper stimulated vigorous interest, and the protagonists and antagonists of spinal anesthesia each had their mighty champions.[8] Clinicians, reflecting on the work of previous investigators, conceded that the anesthetic agents themselves could be toxic, but suggested that some other and additional substance, inadvertently introduced, might contribute to these neurologic disasters.[9] In this regard, the most likely miscreant was the solution used to sterilize the ampules, which in some manner might soak into the vials, probably because of a defective seal, and contaminate the anesthetic. Though this theory seems implausible, it is actually a real hazard, and Coakley at the George Washington University Hospital has informed me that he finds three or four such defective ampules a year. Coloring the sterilizing solution in which the ampules are immersed, so that any invasion of the anesthetic agent can be readily detected, has been a simple expedient in reducing the chance of this type of casualty.[10] Recently, however, Searles and Nowell[11] have studied the role of these sterilizing solutions in the production of neurologic damage and have concluded that the coloring of the antiseptic solution probably gives inadequate protection and a false sense of security to the anesthetist employing spinal anesthesia, for the dilution factor of contaminants is great. Since there is little evidence that allergy plays a part in the production of the neurologic sequelae of spinal anesthesia, and since trauma apparently plays no role at all, one must inevitably return to the inherent toxicity of the spinal anesthetic agent itself as the prime factor.

These complications, in general, may be divided into two categories. In the first group the changes are wrought by the offending agent upon nervous tissues themselves. Because the neurologic consequences are the result of destruction and are apt to be immediate, they are not germane to the topic under discussion. This is what is commonly referred to in the literature as the cauda equina syndrome. This phase of neurologic complications is dealt with in the papers by Kamman and Baker;[12] Ferguson and Watson,[4] and others.[13]

The second type of reaction, and one much more likely to be delayed, is the development of chronic, adhesive arachnoiditis. Hayes and Smith[14] have described its presence in a case with symptoms as early as four days following spinal anesthesia, but it is doubtful whether the neurologic symptoms were due to the arachnoiditis present, *per se*, or to the accompanying nervous tissue damage.

The pathologic character of this delayed reaction in its earliest stages is not well known. Davis and his co-workers,[1] as well as Kamsler[15] have shown that inflammation of the leptomeninges, in varying degrees, is a constant concomitant of spinal anesthesia. This is true particularly when continuous spinal anesthesia is administered via a catheter or a plastic tube. In its completely evolved form the microscopic picture is that of a dense, collagenous, fibrous cuff surrounding and constricting the spinal cord and adjacent vessels and containing, in its interstices, scattered aggregations of inflammatory cells. Figure 1 is typical of the microscopic appearance of chronic adhesive arachnoiditis.

The diagnosis of spinal arachnoiditis is rather infrequently made by neurologists and neurosurgeons, and naturally, without operative confirmation of that diagnosis, it is held suspect in many instances. However, during the year of 1949, on three occasions, patients were seen in whose cases clinical diagnoses of tumor of the spinal cord were made, only to have it discovered at operation that dense adhesive arachnoiditis was present, which frequently involved the dura as well. Shortly after observation of the third case, a patient with far advanced carcinoma of the uterus and bilateral pain and spasticity of the lower limbs was referred to the neurosurgical service for cordotomy. In the operating room my associates and I were surprised and distressed to find such dense arachnoiditis involving the upper dorsal portion of the cord that its rotation for the performance of anterolateral cordotomy was impossible. Struck by the coincidence of an allegedly rare disorder appearing four times during a relatively short period, we sought a common denominator. Our search was rewarded by several evocative coincidences:

The surgical level of the lesion was at the sixth thoracic vertebral body in all 4 cases. In 2 of the 4 cases this was demonstrated by myelogram. The sensory level invariably included the lumbar segments and the thoracic segments up to the tenth dermatome and frequently extended as high as the eighth, but never any higher.

The clinical picture of transverse myelitis was, as a rule, that of an incomplete lesion, with some scattered sensory preservation in one or more modalities below this level. The motor involvement was that of spasticity, with spontaneous and at times painful flexor spasms.

These 4 patients all had undergone abdominal operations in the immediate past (from three months to one year earlier), for which continuous spinal anesthesia was used. These operations were all protracted, i. e., about four hours, and in 2 instances the intra-abdominal operative procedures were repeated twice, each time with continuous spinal anesthesia. The anesthetic agent was invariably procaine.

These observations naturally raised the question of a causal relation between continuous spinal anesthesia and the development of delayed adhesive arachnoiditis. The level of the lesions was always in the neighborhood of the sixth dorsal vertebra, which represents the nadir of normal dorsal kyphosis when the patient is supine. In this position, the anesthetic agent introduced into the subarachnoid space tends to pool at a higher concentration at this level than at other points. Finally, a study of the anatomic aspects of the blood supply of the spinal cord revealed that the descending anterior spinal artery, the chief nutrient channel of the cord, dwindles away in this region, forming casual anastomoses with coronal vessels from the dorsal region and diminishing twigs of an ascending anterior spinal artery arising in the neighborhood of the conus. Therefore, any mechanical compressive interference involving the whole cord would be more devastating here than elsewhere. Figure 2 shows the blood supply of the spinal cord and its greater susceptibility at the level of the sixth dorsal vertebra.

As a result of this experience, I have searched the wards and my private practice for other cases. Five more have been found. Myelographic studies were performed in 4, in 1 of which a block was revealed at the sixth thoracic level (Fig. 3) ; 3 others showed the telltale streaking of the iodized oil at the sixth dorsal level, and in the fourth a clinical diagnosis only was made. In all respects these cases resembled the earlier ones in which operation had been performed. I should like to report what I consider a typical case of chronic adhesive arachnoiditis as a delayed sequel to the administration of continuous spinal anesthesia.

L. D., a 50-year-old Negro teacher, was first admitted to the Freedman's Hospital on June 27, 1948, with a diagnosis of intestinal obstruction. A laparotomy was done, with lysis of adhesions, subtotal hysterectomy and appendectomy. Spinal anesthesia was employed, 150 mg. of procaine being used. The patient was discharged two weeks later. On August 25 she was readmitted with a history of abdominal pain and vomiting of two days' duration. Roentgenograms indicated obstruction of the large bowel. On the following day a cecostomy was done, again with spinal anesthesia (amount of procaine not known). One week later, with the patient under continuous spinal anesthesia, a resection of the splenic flexure of the colon was done for carcinoma, 650 mg. of procaine being used. The postoperative course was not remarkable, and the patient was discharged four weeks later. Three months after her discharge she was again readmitted, with a complaint of weakness in the legs and involuntary mass movements of both legs. The condition appeared to be progressive. There was no pain. Significant observations included anesthesia of the right leg over the fourth and fifth lumbar levels and hypesthesia at the eighth thoracic dermatome, below which hypesthesia to pinprick was present. Tendon reflexes were absent in the legs, and bilateral Babinski signs were present. There was some retention of urine. The lumbar puncture yielded only a few drops of xanthrochromic fluid which promptly clotted in the tube. There was no rise on jugular compression. Roentgenograms of the bony spine were normal. Laminectomy, done shortly thereafter, revealed dense, adhesive arachnoiditis from the sixth thoracic level down. Postoperatively, complete spinal paralysis developed from the eighth dorsal level downward, and the patient failed progressively, dying in February 1949. Permission for autopsy was not granted.

In this case an intimate relation between the development of the paraplegia and the repeated administration of a spinal anesthetic seems quite evident. More frequent, however, is the appearance of the insidious onset of weakness in the legs, vague thoracic sensory levels and sphincter disturbances apparently arising spontaneously. Because of my experience with similar cases, I regularly examine the abdominal wall for scars or question the patient very closely with regard to any prior surgical treatment and the kind of anesthesia employed when tumor of the spinal cord is suspected and the clinical localization appears to be in the neighborhood of the sixth thoracic vertebra. This is a rewarding measure; it has saved at least 3 of my subsequent patients from unnecessary surgical intervention. I use the term advisedly, for it has been my experience that at no time has the patient benefited from

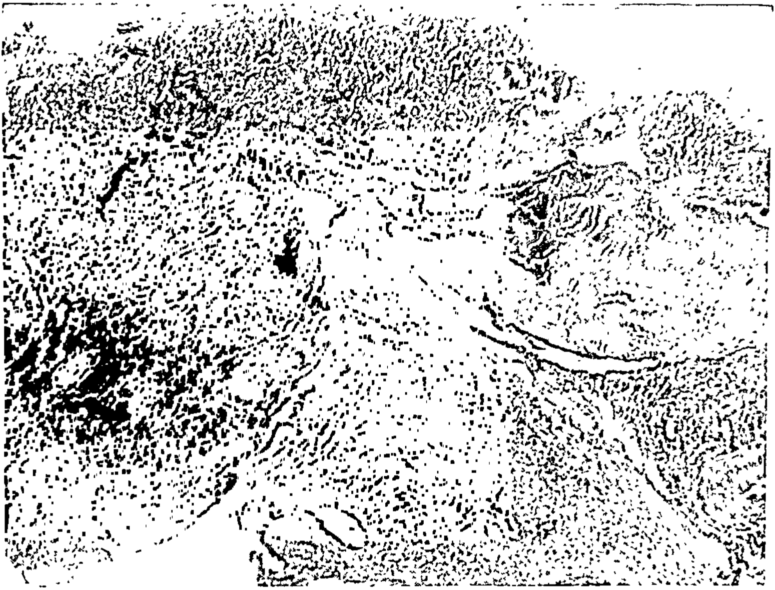
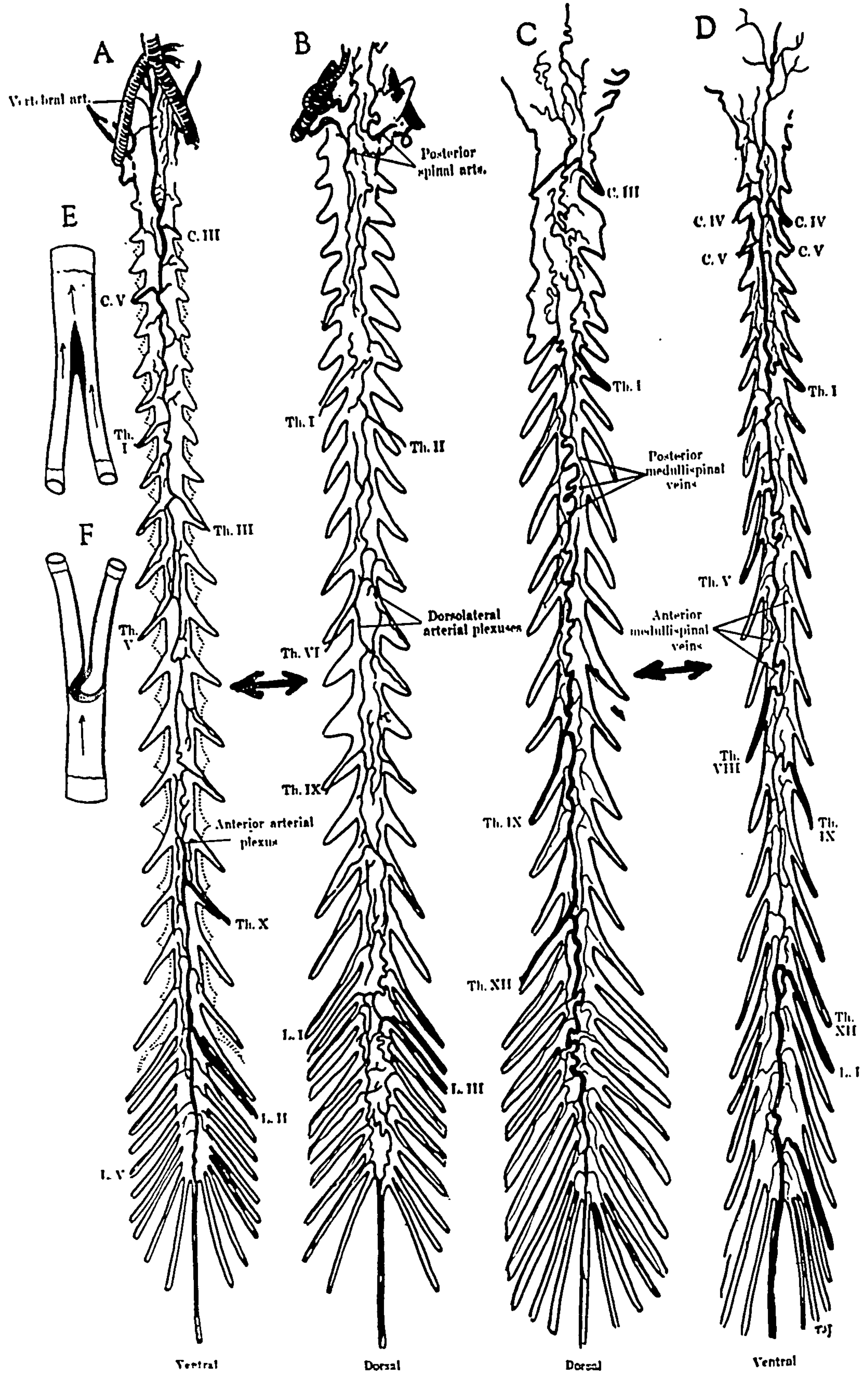


Fig. 1.—Spinal arachnoiditis from L. D. Note the dense collagenous tissue interspersed with areas of low grade inflammation. (Hematoxylin and eosin, × 1003.)

surgical exploration in the presence of chronic adhesive arachnoiditis. Indeed, I have been dismayed to discover, in reviewing my cases, that in those in which operation was performed the paraplegia was, for the most part, intensified.

How does chronic adhesive arachnoiditis produce its devasting effects upon neural structures within the spinal canal? One answer might be that it progressively chokes the axons traversing the area and the neuronal beds lying within it. This probably is not actually the case, for, as is well known, nerve tissue can stand a vast amount of compression over a long period without showing much disturbance of function. It is more likely that the damage done by arachnoiditis results from its effect upon the vascular supply to the spinal cord, attenuating the blood flow and starving the nervous tissues. The following case documents the validity of this concept of pathogenesis.

B. K., a 64-year-old man, was first seen in May 1949, complaining that for approximately one year he had noted progressive weakness in both legs. This had advanced to such a point *that he could walk only with the greatest difficulty.* Lately a troublesome constipation had appeared, and nocturia disturbed his sleep. For several years he had been treated for hypertension. When not under active treatment, his blood pressure in millimeters of mercury ranged in the neighborhood of 180 systolic and 90 diastolic. Under treatment with Priscoline®, however, the blood pressure was *reduced to 110 systolic and 65 diastolic,* and symptoms of paresis of the lower extremities became severe in a matter of hours. When therapy was relaxed and the blood pressure rose to 160 systolic and [illegible] weakness of the legs [illegible]


A
B
C
D
E
F
Vertebral art.
Posterior spinal arts.
C. III
C. V
Th. I
Th. III
Th. V
Anterior arterial plexus
Th. X
L. II
L. V
Th. I
Th. II
Dorsolateral arterial plexuses
Th. VI
Th. IX
L. I
L. III
C. III
Th. I
Posterior medullispinal veins
Th. IX
Th. XII
C. IV
C. IV
C. V
C. V
Th. I
Th. V
Anterior medullispinal veins
Th. VIII
Th. IX
Th. XII
L. I
TJ
Ventral
Dorsal
Dorsal
Ventral

Treatment by a reducing diet and a rice diet produced the same results. Finally a compromise *pressure of 145 systolic and 90 diastolic* secured for the patient the optimum result.

The past history revealed that in February 1948, fifteen months earlier, he had noted a *swelling in the right testicle. With the patient* under spinal anesthesia, a hydrocele was discovered and corrected. It was some three months after this operation that the patient first began to have trouble with his legs.

On physical examination the blood pressure was 156 systolic and 90 diastolic and the cranial nerves were normal. Reflexes in the upper extremities were absent. The epigastric reflexes were present and active, while the lower abdominal and cremasteric reflexes were absent. Knee jerks and ankle jerks were present, the right patellar jerk being more brisk than the left. There was no response to plantar stimulation. There was approximately 50 per cent diminuation in tone, strength and speed of movement of the lower extremities, with slight atrophy, if any. Sensory examination revealed a definite sensory level at the ninth dorsal dermatome. This was present to testing with pin, ice, vibration and light touch. Joint sensibility was largely intact. Roentgenograms of the dorsal portion of the spine were completely normal. Spinal puncture revealed a total protein content of 100 mg. per hundred cubic centimeters, with the presence of three cells. Spinal manometric study did not reveal a block, but the fluid rose and fell slowly in the manometer on jugular compression. A myelogram was made, which showed an irregular stringing out and fragmentation of the iodized oil in the mid-dorsal region, past which oil flowed with difficulty on one side only.

On the basis of the history and the neurologic and myelographic observations, a diagnosis of spinal arachnoiditis was made. Surgical confirmation was not advised. The patient continued in a sedentary way of living until he had a stroke in 1951. This left him bedridden and with hemiplegia. At the time of *writing he is in a nursing home.*

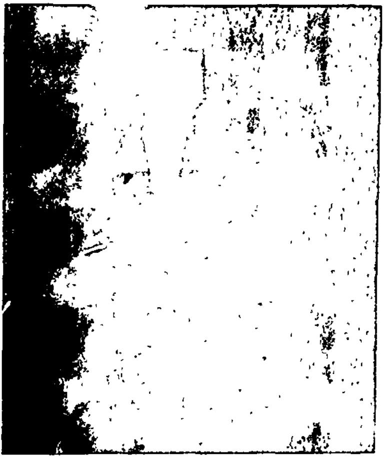


Fig. 3.—Myelogram showing almost complete obstruction and characteristic streaking of iodized oil in the presence of spinal arachnoiditis.

This case provides strong inferential evidence of the constrictive effect of arachnoidal proliferations on the circulation of the spinal cord. Some degree of hypertension appears to have held in abeyance more serious damage due to arachnoiditis. This suggests that the pathologic physiologic condition illustrated here is *the basis of the grave and usually* irreversible neurologic consequences of chronic spinal arachnoiditis. Supporting evidence of this has been observed by Haymaker[16] in his studies on decompression sickness. He has noted that the brunt of the injuries borne by the nervous system in this disease fall upon the mid-dorsal region of the spinal cord and result from the relative paucity of nutrient vascular channels.

## SUMMARY

Of the 9 patients observed by the author, 2 of whose cases are reported here

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Fig. 2. (*opposite*).—Diagram of circulation of spinal cord, showing paucity of anastomotic channels in the neighborhood of T-6 (arrows). From F. A. Mettler, *Neuroanatomy, 2d ed.* 1948, courtesy of the C. V. Mosby Co., St. Louis, Mo.

in detail, all were between 40 and 65 years of age at the time of onset of their neurologic symptoms. Eight of the 9 were operated upon for pelvic or intra-abdominal disease and lay supine on the operating table or in a mild Trendelenburg position. The ninth, who had a hydrocele, though probably also flat, may have been tilted in the lithotomy position. The earliest neurologic symptoms appeared three months after the induction of spinal anesthesia; the latest, after two and one-half years.

All, as indicated before, had maximum neurologic levels in the neighborhood of the sixth dorsal, though frequently the greatest deficit was apparent at the lumbar and sacral levels. The clinical picture was that of a transverse myelitic lesion, as opposed to the "cauda equina syndrome" with lower motor neuron abnormalities. Four of the 9 patients with arachnoiditis were operated upon. Though no extensive resection was attempted, 3 of the 4 were worse, and 1 was certainly no better. Finally, all 9 patients recovered from their initial operations and anesthesia and left the hospital without neurologic symptoms. This is probably the most sinister aspect of this disorder, for those who performed the operations and gave the anesthetic are probably unaware that their services carried later reprisals.

## CONCLUSIONS

1. Spinal anesthesia can cause late and vast neurologic damage by initiating a granulomatous, leptomeningeal proliferation.

2. This damage is unsuspected for some months after the induction of anesthesia.

3. It most frequently causes neurologic signs at the sixth dorsal level and suggests tumor.

4. The symptoms result from the constrictive effect of the arachnoiditis upon the vascular channels of the spinal cord, the least competent of which are in the mid-dorsal region.

5. Surgical intervention has small salvage value in such cases.

## DISCUSSION BY DR. HAROLD C. VORIS, CHICAGO

It is a pleasure and a privilege to congratulate Dr. Williams on presenting this clear-cut anatomic and clinical syndrome of a serious late complication of spinal anesthesia. Certainly, from now on, when we are confronted with a patient with evidence of a lesion of the spinal cord at the sixth dorsal segment, we must think of a complication of spinal anesthesia and inquire into the past history of the patient to see whether, in fact, he has undergone spinal anesthetic. My own experience with complications of spinal anesthesia has been essentially with the first type of patient to which Dr. Williams referred, namely, the patient who shows immediate consequences due to the acute action of the anesthetic agent on the tissue of the spinal cord. In 1 such case exploration was done because the clinical picture was complicated by the fact that the patient had fallen from the cart to the floor during his transfer from the operating room to the ward. I think Dr. Williams will be glad to know that in that case at exploration, seventy-two hours after the initial operation and spinal anesthesia, marked opacity of the arachnoid was noted. There was no other gross abnormality. Biopsy of the arachnoid at that time showed intense round cell infiltration. This patient never showed any neurologic improvement, and he died eight weeks later. At necropsy the observations were comparable to those Dr. Williams described.

DR. WILLIAMS: I am very much interested in Dr. Voris' experience. He is one of the few who have had an opportunity to view the arachnoid so short a time after the administration of spinal anesthesia. Kansler has studied quite a number of cases of continuous spinal anesthesia and found cell counts running all the way up to 1,500 cells in an apparently otherwise uncomplicated case. Others have confirmed this work. She reports that in simple spinal anesthesia, when the needle is introduced and then withdrawn, the cell count goes up to maybe one or two hundred. It is my belief that it is the anesthetic agent itself that is responsible for this and not contamination of either the drug or the instruments.

## QUESTIONS FROM THE FLOOR

DR. WATTS: Dr. Williams, do I understand from your presentation that you recommend the total abandonment of spinal anesthesia? Spinal anesthesia, as you know, is still very popular in many of the hospitals in this country. If these are your recommendations and they are followed, it will mean the loss of a valuable tool in the service of the surgeon. Do you think that your observations justify this position?"

DR. WILLIAMS: Dr. Watts, spinal anesthesia is a useful agent. There are times when it is the only anesthetic agent available. I am thinking particularly of my experiences on shipboard during the last war. On more than one occasion I was called upon to administer an anesthetic in order to perform an operation and obviously couldn't do both at the same time. Spinal anesthesia used in such circumstances is unquestionably the anesthesia of choice. There are also times when no other form of anesthetic agent is available. Of course, it should then be used. As you know, surgeons are constantly weighing risks against gains. Today I point out that in a small but significant number of cases serious damage can result to the nervous system from the use of spinal anesthesia and my personal feeling is, speaking with profound interest in and respect for the nervous system, that spinal anesthesia should be reserved for those circumstances where other forms of anesthetic agents are for one reason or another inexpedient to employ.

## DISCUSSION FROM THE FLOOR

DR. SAMUEL LOWIS: I should like to offer a few comments based on a series of 9 personally observed cases. These have not been studied as intensively as Dr. Williams' cases. One of these was in my care from its inception; the other 8 were patients whom I saw in consultation, and on 2 of whom I performed spinal exploratory operations.

In this series of 9 cases, the one common denominator was the fact that all of the patients had previously undergone spinal anesthesia before the one which led to the arachnoiditis. A closer questioning or study of 2 of these, including the one who had been in my care from the onset, showed that we might, with more careful attention to minor details in the history, have recognized an allergic or a toxic reaction to the earlier spinal anesthesia; this would have allowed us to avoid the later anesthesia which led to the serious complication.

A second difference between the observations in these cases and Dr. Williams' cases lies in the fact that in 3 of these the immediate appearance of neurologic signs was noted.

In 1 of these it was thought that the fault lay in contamination of an ampule. This patient never obtained anesthesia after the injection of Pontocaine; ether anesthesia had to be used for the operation, and paraplegia was present from the moment of administration of the drug.

The second patient had undergone a long series of operations for reconstruction of the common duct. In the second operation spinal anesthesia was used, apparently for the first time. There was slow recovery of strength in walking, and this was mistakenly attributed at the time to a prolonged shock reaction, thought to be due to inadvertent tear in the hepatic vein. At the last operation continuous spinal anesthesia was administered, with a level high enough for anesthesia of the diaphragm. I had occasion to explore the lumbar canal of this patient, and observed over an area of 3 cm. (the entire area of the exploration) a dense mass of scar tissue, binding all the nerves together and obliterating the subarachnoid space.

The third patient to be mentioned in detail presented a neurosurgical problem from the beginning. This patient had a ruptured disc, and later a recurrence and a need for refusion; both operations were done with Pontocaine anesthesia. While under anesthesia at the second operation the patient had some difficulty in respiration and a tingling in his arms, although the anesthesia did not ascend to this level, and noted also a prickling sensation in the tongue. For some moments he had to have assistance in respiration. This patient had had to be catheterized for five days after the first operation; little significance was attributed to this at the time, but in retrospect it seemed possible that it was related not to a mechanical difficulty in voiding but to a borderline difficulty related to the anesthesia.

Something may be said about the tissue changes on the basis of the single patient who was studied post mortem. This was the patient who had undergone many operations for disease of the gallbladder. A biopsy had been made at the operation; at autopsy, about three years later, there was observed not only scar tissue of the variety that might have been expected to compress the blood vessels, as Dr. Williams suggested, but infiltration of the scar tissue into the cord to a [illegible] everal mil[illegible] meters. It seemed to [illegible] cas[illegible] at least, this may [illegible] of this lesion. C[illegible] esthetic may [illegible] level, but the patient who had the two operations for disc disease was never in the supine position, and if pooling of the anesthetic was a factor the greatest concentration must have been at the first and second lumbar level.

The problem as to whether this is a toxic or an allergic reaction needs further study. It seems to me, however, that with a relatively higher incidence of serious complications following secondary or later spinal anesthesia, one should whenever possible avoid exposing the patient to the additional risks associated with such occasions.

### CLOSING REMARKS BY DR. WILLIAMS

DR. WILLIAMS: Dr. Lowis described particularly 3 cases which I purposely eliminated from my presentation. These are cases in which the immediate effects of the anesthesia pon the nervous system were apparent. This is the "cauda equina syndrome," which is reported in the vast majority of papers in the literature today in referring to neurologic consequences of spinal anesthesia. It is the acute toxic or allergic, if you please, reaction occurring within minutes or hours after the administration of the anesthetic and even producing 6th nerve palsies and other cranial nerve palsies such as tingling in the tongue as happened in one of Dr. Lowis' cases. Pooling is apparently not important in untoward developments such as these, and consequently this explanation need not be involked to account for the persistence of neurologic abnormalities in that patient of Dr. Lowis' who had a laminectomy and was operated upon in the prone, not the supine, position. With regard to the question whether subtle neurologic abnormalities are really present in those chronic cases though undetected at the time of discharge, it is highly difficult to say. Customarily a neurologic examination is not done upon every patient who has had, for example, a gallbladder taken out, and neither the general surgeon or the anesthesiologist at the time of the discharge is alarmed by any complaints that the patient may make. The patient is apparently well and as far as he and everybody else is concerned, free of trouble.

### RÉSUMÉ

Les neufs patients observés par l'auteur, dont deux cas sont rapportés en détail, étaient âgés entre 40 et 65 ans au moment de l'apparition des symptômes neurologiques. Huit de ces 9 cas avaient été opérés pour une affection pelvienne ou intra-abdominale, couchés sur le dos ou en léger Trendelenburg. Le neuvième malade, atteint d'un hydrocèle, avait été probablement opéré en position couchée ou en position genu pectorale. Les premiers symptômes neurologiques apparurent trois mois après l'anesthésie rachidienne; les derniers furent signalés deux ans et demi après.

Comme l'auteur l'a décrit, le maximum de symptômes neurologiques siégeaient au niveau de la sixième vertèbre dorsale, quoique fréquemment les symptômes les plus graves se localisèrent au niveau de la région lombaire et sacrée. L'image clinique était celle d'une lésion myélitique transversale s'opposant à un syndrome de la queue de cheval. Quatre des neuf malades avec arachnoïdite furent opérés. Bien qu'aucune résection extensive ne fut pratiquée, l'etat de trois des quatre malades empira et le quatrième resta stationnaire. Finalement les neuf malades guérirent de leur première opération et des complications survenues à la suite de l'anesthésie. Ils quittèrent l'hôpital sans symptômes neurologiques. Ces sortes de complications post-opératoires sont, pour le chirurgien, des plus décevantes.

### CONCLUSIONS

1. L'anesthésie rachidienne peut causer des troubles neurologiques tardifs et importants en produisant une prolifération granulomateuse, au niveau des méninges.
2. Aucun symptôme ne se manifeste durant quelques mois après l'anesthésie.
3. Les signes neurologiques surviennent le plus fréquemment au niveau de la sixième vertèbre dorsale et font penser à une tumeur.
4. Les symptômes proviennent des effets spastiques des vaisseaux situés au niveau de la moelle (arachnoïdite), dont les moins développés siègent au niveau de la région dorsale.
5. Dans ces cas, l'intervention chirurgicale n'a pas d'effet.

## ZUSAMMENFASSUNG

Alle neun vom Verfasser beobachteten Kranken, von denen er zwei hier ausführlich schildert, befanden sich zur Zeit des Auftretens der neurologischen Symptome in Alter zwischen 40 und 65 Jahren: Von den neun Kranken wurden acht wegen Becken-oder Baucherkrankungen operiert und lagen auf dem Operationstisch in flacher Rückenlage oder in leichter Trendelenburgscher Lage. Der neunte hatte eine Hydrozele und lag wahrscheinlich auch flach, kann aber vielleicht in Blasenschnittstellung gedreht worden sein. Die ersten neurologischen Symptome traten drei Monate nach Enleitung der Rückenmarksanästhesie, die spätesten nach zweieinhalb Jahren auf.

Bei allen Patienten gehörten die maximalen neurologischen Symptome der Nachbarschaft des sechsten Dorsalsegments an, wenn auch häufig die grössten Ausfälle in der Höhe des Lenden-und Sakralmarks in Erscheinung traten. Das klinische Bild war das einer Querschnittsmyelitis im Gegensatz zum "Cauda equina-Syndrom" mit Anomalien des unteren motorischen Neurons. Vier der neun Kranken mit Arachnoiditis wurden operiert. Obgleich kein Versuch einer umfangreichen Resektion unternommen wurde, erfuhren drei von den vier eine Verschlechterung, und der vierte sicherlich keine Besserung. Alle neun Patienten überstanden die ursprüngliche Operation und Anästhesie gut und verliessen das Krankenhaus ohne neurologische Erscheinungen; und darin liegt wohl das Tückischste dieser Erkrankung, dass diejenigen, die die Operation ausführten und die Anästhesie verabfolgten, wahrscheinlich garnicht wissen, zu welchen Nackenschlägen ihre Handlungen später führten.

## SCHLUSSFOLGERUNGEN

1. Die Spinalanästhesie kann zu granulomatösen leptomeningealen Wucherungen führen und auf diese Weise späte und umfangreiche neurologische Schädigungen hervorrufen.
2. Mehrere Monate lang nach Einleitung der Anästhesie bestehen keine Verdachtsmomente für die Schädigung.
3. Meistens kommt es zu neurologischen Krankheitserscheinungen in Höhe des sechsten Dorsalsegments, die den Verdacht auf Tumor erwecken.
4. Die Symptome sind die Folge einer Einschnürung der Gefässe des Rückenmarks durch Arachnoiditis; die schwächsten Gefässe liegen in der Gegend der *mittleren Brustwirbelsäule.*
5. Chirurgische Behandlung ist in diesen Fällen von geringem Wert.

## RESUMEN

De 9 pacientes observados por el autor, 2 de ellos comunicados en detalle, todos estuvieron entre los 40 y 65 años de edad al comienzo de sus síntomas neurológicos. Ocho de los 9 fueron operados de padecimientos pélvicos ó abdominales y permanecieron en posición supina sobre la mesa de operaciones ó bien en moderado Trendelenburg. El noveno que tenía un hidrocele aun cuando probablemente plano pudo haber sido inclinado en posición de litotomía. Los primeros síntomas neurológicos aparecieron tres meses después de una inducción con anestesia raquídea; el último después de dos años y medio.

Como se indicó anteriormente todos tuvieron niveles neurológicos máximos en la vecindad de la sexta dorsal, aun cuando el déficit mayor fué en niveles lumbares y sacros. La imagen clínica fué la de una mielitis transversa, antagónicamente al síndrome de "cauda equina" con anormalidades de motoneurona inferior. Cuatro de los 9 pacientes con aracnoiditis fueron operados. Aun cuando se intentó una resección masiva, 3 de los 4 empeoraron y 1 lo hizo en una forma definida. Finalmente, los 9 pacientes se recuperaron de la operación inicial y anestesia y dejaron el hospital sin síntomas neurológicos. Esto es uno de los aspectos más siniestros de esta perturbación ya que aquellos que administran los anestésicos y operan no se dan cuenta de que sus servicios acarrean represalias.

## CONCLUSIONES

1. La anestesia raquídea puede ser una causa de amplias lesiones neurológicas tardías produciendo proliferación granulomatosa leptomeníngea.

2. Este lesión pasa desapercibida por algunos meses después de la inducción anestésica.

3. La causa más frecuente de signos neurológicos se encuentra a nivel de la sexta dorsal y sugiere tumor.

4. Los síntomas resultan del efecto constrictivo de la aracnoiditis sobre los conductos vasculares de la médula espinal, que son menos competentes en la región media torácica.

5. La intervención quirúrgica tiene un valor muy limitado en tales casos.

## RIASSUNTO

Dei 9 pazienti studiati dal l'autore, 2 dei quali riferiti dettagliatamente, tutti avevano un'età fra i 40 e i 65 anni al momento dell'insorgenza della sintomatologia neurologica. Su 8, dei 9, era in corso un intervento per stati patologici intra-addominali o pelvici e giacevano sul tavolo operatorio supini o in posizione di Trendelemburg. Il nono, che aveva un idrocele, doveva essere in posizione di litotomia. I primi sintomi neurologici apparvero a tre mesi di distanza dall'esecuzione dell'anestesia spinale; i tardivi dopo 2 anni e mezzo. Come si è già detto, la massima altezza del livello neurologico era in tutti i casi sulla sesta dorsale, per quanto il deficit più grave era frequentemente ai livelli lombare e sacrale. Le manifestazioni cliniche erano quelle di una mielite trasversa, in opposizione alla "sindrome della cauda equina" con disturbi del neurone motorio inferiore. Quattro dei nove pazienti con aracnoidite furono operati: ma, per quanto non fosse stata eseguita una dissezione estesa, tre dei quattro peggiorarono e uno non migliorò certamente. Alla fine, però, tutti i 9 pazienti lasciarono l'ospedale senza disturbi neurologici. L'aspetto forse peggiore di tali sindromi post-anestetiche è rappresentato dal fatto che i chirurghi e gli anestesisti che originariamente eseguirono gli interventi e le anestesie non furono probabilmente informati che la loro opera era stata tardivamente seguita da disturbi neurologici.

## CONCLUSIONI

1. La rachianestesia può causare lesioni neurologiche gravi e tardive, dando origine a processi granulomatosi leptomeningei.

2. Tali lesioni passano inosservate per alcuni mesi dopo l'esecuzione della rachianestesia.

3. Esse, il più di frequente, producono disturbi neurologici a livello della sesta dorsale e fanno pensare ad un tumore.

4. I sintomi sono caucati dallo strozzamento da parte dell'aracnoidite, della rete vascolare del midollo spinale—che è appunto funzionalmente meno valida nella regione dorsale media.

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A very unusual use for which the microscope was employed is reported from England. In Yorkshire there is an ancient church which dates from the earliest period of English history. On the rough oak door of this church were some fragments of material, hardened and blackened by time, nailed there with heavy spikes. According to a tradition almost as old as the church, these bits of hardened material were the remnants of the skin of an early Danish invader who had attempted to violate the sanctity of the church, but had been captured by the irate villagers, skinned alive, and his skin nailed to the church door as a warning to trespassing, blaspheming Danish pirates.

A certain curious person, to test the truth of this legend, took a piece of this material and examined it under a microscope. This examination showed that when the formless piece of material was magnified under the microscope, cells were very clearly seen. Further study showed that it was really a piece of skin, and that on its surface were small blond hairs, characteristic of the early invaders of England. Thus the venerable tradition was substantiated to the degree at least of proving that it was human skin, belonging to a person with light hair, and very probably a Dane.

—*Major*

# Spinal Cord Reflexes

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IT IS not the purpose of this presentation to describe several kinds of spinal reflexes. Instead, I prefer to discuss the problem of how spinal reflexes in general can be modified and regulated from higher levels of the nervous system.

First, it may be necessary to define spinal cord reflexes. Of course, they are reflexes mediated by the spinal cord itself, or, in other words, the reflex arcs are restricted to the spinal cord and do not xtend into higher levels. But how does ne find out whether a reflex belongs to this group or not? Sometimes the latency of the reflex is short enough to tell the story. But if the latency is longer the method is to find out whether the reflex can be mediated by a spinal cord completely separated from higher levels of the nervous system.

It must be remembered, however, that an isolated spinal cord is working under very unphysiologic conditions, and in the normal intact animal the spinal cord reflex may be impossible to evoke, because of tonic descending influences from above which normally maintain a depression of the spinal neurons involved. Similarly, there may be spinal reflexes that cannot be mediated by an isolated spinal cord because the spinal neurons involved in the reflex arc depend for their normal function upon tonic facilitatory influences from higher centers.

Thus, it seems evident that, in order to obtain a better understanding of spinal reflexes, one must learn more about the descending pathways from above that normally influence the activity in the spinal cord.

Let us start with the relatively simple monosynaptic stretch reflex and see how this reflex can be influenced from higher centers. The sense organs from which the reflex originates are the muscle spindles. When a muscle is stretched—as, for instance, when one elicits the knee jerk—the stretch applied upon the muscle spindles brings about an afferent discharge from these endorgans. This sensory discharge is conducted in the afferent fibers connecting the muscle spindle with the spinal cord. Many of these spindle afferents pass directly through the spinal cord and reach the motor neuron in the ventral horn without involving any intermediate neurons in the spinal cord. Thus the only synaptic junction in this reflex arc is the one on the motor neuron. If the afferent influx from the muscle spindle is strong enough the motor neuron is brought into activity and motor impulses are conducted in the efferent nerves to the muscle that contracts.

This monosynaptic stretch reflex, which forms the basis of other postural reflexes, can be interfered with and regulated in many different ways. Thus, it is known that pyramidal fibers can influence the excitability of the motor neurons. These descending fibers, however, do not make direct contact with the motor neurons. They are connected to interneurons in the spinal cord, and thus they reach the motor neurons in an indirect way. Destruction of the pyramidal fibers causes paralysis but no spasticity, no exaggeration of the stretch reflex and no increased tonus in the muscles. There is no doubt that corticospinal fibers are mainly concerned with the regulation of voluntary movements. Tremor and other involuntary movements in man, however, are also abolished after section of the pyramidal tract. This does

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not necessarily mean that the repeated, synchronized, descending volleys responsible for tremor arise in the motor cortex and are conducted to the motor neurons by the pyramidal tract. It seems more likely that the corticospinal tract contributes such an essential facilitative background for motor neuron activity that the pathologic, descending synchronized volleys from other sources are unable to reach the threshold in its absence. This question, however, is an important one, for its answer should determine whether or not it is possible to relieve involuntary movements by neurosurgical methods in man without, at the same time, paralyzing the patient.

The excitability of the motor neuron is influenced not only by the corticospinal fibers but by the descending extrapyramidal pathways. During recent years special attention has been drawn to the reticulospinal connections that obviously emerge as the major final common paths of the extrapyramidal motor system. Not only the cerebral cortex and the cerebellum but the basal ganglia utilize reticular relays in the brain stem in exerting many of their influences upon the cord. Like the pyramidal fibers, most of the reticulospinal fibers do not make synaptic connection directly with the motor neuron, but spinal interneurons are involved in the transmission.

The effect of the reticular formation upon the spinal motor neurons depends upon what region of the reticular formation that is activated. Stimulation in the lower bulbar part of the reticular formation usually inhibits or diminishes the excitability of the motor neurons, but stimulation in the midbrain reticular formation usually causes an increase in their excitability.

The inhibitory bulbar reticular formation receives connections from the suppressor areas of the cerebral hemispheres and the cerebellum. Injury to the suppressor areas in the cat produces spasticity, evidently because of the fact that the inhibitory bulbar reticular formation is left without inflows to maintain its activity. The typical feature of this spasticity is exaggeration of the stretch reflexes in all muscle groups of the extremity, but most pronounced in the functional extensors. The exaggeration of the monosynaptic stretch reflex, however, is not due to an intrinsic ability of the motoneurons to increase their excitability when released from suppression. Their increased excitability is due to facilitative influx from the brain, normally balanced by suppression, but exerting an augmented influence in its absence. Thus a preexisting spasticity can be greatly diminished by lesions in the facilitative midbrain reticular formation. The results indicate, however, that the reticulospinal facilitatory discharge is the major but not the sole influx maintaining spasticity. Some is derived also from the vestibular nuclei, injury to which, when added to midbrain reticular destruction, eliminates residual spasticity.

These observations clarify the results of neurosurgical attempts to relieve spasticity in man by section of facilitatory paths in the cord. Spasticity is not prevented by section of vestibulospinal tracts in the human cord. The facilitatory reticulospinal pathways must also be transected. These facilitatory paths maintaining spasticity are concentrated in the ventral half of the cord, but their widespread distribution suggests that effective interruption might leave the patient with spasticity relieved but more incapacitated than before.

Hypokinesia, as well as involuntary movements, can be produced experimentally in animals after the occurrence of lesions in the midbrain reticular formation or in extrapyramidal structures connecting with it. Much of the immobility of hypokinesia, however, appears due to lack of will to move rather than to paralysis of movement. Thus, while reduction of excitation within the cord may be in part responsible for the effect, there are indications that a defect at the cerebral level may also be involved, showing that the affected part of the brain stem exerts influence upon the upper as well as the lower levels of the nervous system.

So far we hav [illegible] sted

suprasegmental influences upon the motor neuron, that is, the efferent part of the monosynaptic stretch reflex. Quite recently it has been shown, however, that the afferent link in this reflex is also under the influence of descending pathways from higher levels. It has long been known that among the efferent nerve fibers in the ventral root which innervate the motor units in the muscles there are smaller efferent fibers which also pass down to the muscles. Now it has been definitely proved that in mammals the only function of these small, so called gamma efferent nerve fibers is to innervate the muscle spindles. Thus activity in the gamma fibers does not cause any contraction of the muscle but an increased afferent discharge from the muscle spindles. It has also been demonstrated that the efferent gamma system is tonically activated from central regions and that stimulation of various central nervous structures influences the afferent discharge from the muscle spindles. One main difference between the activity of the gamma fibers and the ordinary motor neuron discharge is this: In normal rest, when the muscles are completely relaxed, the ordinary motor neurons are silent; there is no spontaneous activity going on in the motor units; but there is constant background activity in the small gamma efferents, which thus maintains a certain degree of excitability in the muscle spindles. Since the afferent discharge of the muscle spindles has a marked effect on the excitability of the ordinary motor neurons, it is obvious that one is here dealing with an external circuit by means of which higher levels of the nervous system, in an indirect way, can regulate the excitability of the motor neurons.

The most powerful inhibitory effect on the activity of gamma efferents and spindle afferents was obtained by stimulating the bulbar reticular formation, and the most powerful excitatory effect is obtained from the midbrain reticular formation. Thus it is obvious that extrapyramidal pathways are those mainly responsible for the suprasegmental regulation of the efferent gamma system, but it is not unlikely that pyramidal fibers also are capable of influencing the gamma efferent discharge. The clinical significance of the whole gamma system is still unknown, but there is no doubt that it plays an important role in the regulation of tonic muscular activity. It is also worth pointing out that transection of a dorsal root can no longer be regarded as a strictly peripheral affair. Actually, this operation deprives the spinal cord of some of the descending influences from higher levels.

This has been a short description of how the monosynaptic stretch reflex can be influenced from higher levels. It still remains to describe how other spinal cord reflexes which are not monosynaptic but polysynaptic can be regulated from above. Of course, a polysynaptic reflex is one in which the reflex arc includes a series of interneurons between the sensory and the motor side, and a typical spinal polysynaptic reflex is, for instance, the flexor reflex. Since the motor neuron in the ventral horn is the only final common pathway for all spinal reflexes, it is evident that descending pathways capable of influencing the excitability of these ventral horn cells have an effect also upon all spinal reflexes, monosynaptic as well as polysynaptic. But the problem is whether a polysynaptic reflex can be interfered with not only at the motor neuron junction but also at some early synapses in the reflex arc. The answer to this question is important, not only for a better understanding of the suprasegmental regulation of spinal reflexes but for understanding of the mechanisms involved in transmission of afferent impulses within the cord.

It is known that many ascending afferent pathways in the spinal cord are made up by branches of the same interneurons that participate in spinal polysynaptic reflexes. Thus, if one supposes that the synaptic junction between the incoming afferent fiber and the first interneuron in the spinal cord is under the physiologic influence of descending pathways, one has the necessary premises for suprasegmental regulation not only of spinal polysynaptic reflexes but of afferent conduction in the spinal cord. This problem has recently been investigated by neurophysiologic methods in cats, and the results indicate that sensory relays in the spinal cord are normally under a tonic influence from higher levels and that stimulation of extrapyramidal structures in the brain can inhibit the afferent synaptic transmission in the spinal cord. As yet it is not known whether the pyramidal tract also has a regulating effect upon the sensory side of the spinal cord, but it does not seem unlikely.

Much work remains to be done before the intimate connections between the spinal cord and the rest of the nervous system are fully understood. There is no doubt, however, that the more one learns about these connections the better one will be able to interpret the mechanism behind many clinical manifestations of disturbance in the central nervous system.

## DISCUSSION BY DR. GRAYSON P. MCCOUCH, PHILADELPHIA

DR. MCCOUCH: I am glad that, in Dr. Hagbarth's lucid presentation of recent work on the influence of descending pathways, he has stressed the fact that there are many problems still unsolved.

Of these, one of the more obvious is the influence of the reticular formation upon decerebrate rigidity. A transection extending from the intercollicular region dorsally to the superior margin of the pons ventrally removes the major portion of Magoun's falicitatory area, leaving most of his inhibitory area intact. Yet the result is a release of excess extensor activity with inhibition of flexor neurons. The same result may be produced by relatively small bilateral lesions just internal to the red nuclei. As Dr. Hagbarth has stated, the rigidity is maintained in part through the vestibulospinal tracts. Yet it may persist after either acute or chronic destruction of both labyrinths. An answer is suggested by results recently reported by Sprague and Chambers, who have noted that weak, sharply localized stimuli in either the facilitatory or the inhibitory area give reciprocal effects.

Dr. Hagbarth has stressed the quantitative changes resulting from removal of descending impulses. There are also qualitative changes. Of these the most familiar is in the plantar reflex. When the large corticospinal supply to the foot is cut off, the spinal centers employ the long muscles to the digits (muscles that span two joints) for the gross purpose of ankle flexion, without regard to their effect upon the toes. With a sufficiently painful stimulus, dorsiflexion of the toes may be elicited even in the normal subject, the primitive spinal type of response dominating cerebral control.

One of the most fascinating observations Dr. Hagbarth has reported is the evidence that sensation may be inhibited at the spinal level by descending impulses. With characteristic modesty, Dr. Hagbarth refrained from stating that this is his own most recent contribution.

## QUESTIONS FROM THE FLOOR

QUESTION: Is there any evidence that the efferent gamma system is present in man, and, if so, is it known that it has the same function as in the cat?

DR. HAGBARTH: It is known that efferent gamma fibers exist also in man. I don't think any clinical experiments have been done to elucidate the function of these fibers, but it seems quite reasonable to assume that the fibers, have a similar function in cat and in man.

QUESTION: Are the efferent gamma fibers in the ventral root in any way separated from the ordinary motor fibers? Would it not be possible, for instance, to transect the gamma fibers without influencing the innervation of the ordinary muscle fibers?

DR. HAGBARTH: In the ventral root the gamma fibers are all intermingled with the ordinary motor fibers. So far there is no method for selective destruction of either of these two fiber systems.

## ZUSAMMENFASSUNG

Der Verfasser erörtert die Modifizierung und Regulierung spinaler Reflexe von höher gelegenen Zentren des Nervensystems aus. Die Rückenmarksreflexe werden definiert als solche, die nach völliger Abtrennung von höher gelegenen nervösen Zentren vom Rückenmark vermittelt werden können; es wird allerdings darauf hingewiesen, dass Hemmung durch tonis-

che Einflüsse oder Ausbleiben erleichternder Einflüsse von oben die Auslösung des Rückenmarksreflexes unmöglich machen können. Der Verfasser erklärt die Art und Weise, in welcher der Reflex von höheren Zentren reguliert wird, und benützt den verhältnismässig einfachen monosynaptischen Streckreflex als Beispiel. Auf die Erörterung polysynaptischer Reflexe, z. B. des Beugungsreflexes, wird nicht eingegangen; allerdings bemerkt der Verfasser, dass absteigende Nervenbahnen, die imstande sind, die Erregbarkeit der Vorderhornzellen zu beeinflussen, einen Effekt auf alle Rückenmarksreflexe ausüben. Das Problem ist, ob ein polysynaptischer Reflex nicht nur an der Schaltstelle des Motorneurons sondern ausserdem noch an einer früheren Synapsis im Reflexbogen unterbrochen werden kann. Die Beantwortung dieser Frage ist von Bedeutung nicht allein zum besseren Verständnis der Regulation von Rückenmarksreflexen sondern auch zur Erklärung des Mechanismus, der bei der Übertragung afferenter Impulse innerhalb des Rückenmarks eine Rolle spielt.

### RESUMEN

Los autores discuten la modificación y regulación de los reflejos medulares de los niveles superiores del sistema nervioso. Los reflejos medulares se definen como aquellos que pueden ser mediados a traves de la médula espinal completamente separada de los niveles superiores, aunque se señala que por influencia tónica ó ausencia de acción facilitarora superior puede hacerse imposible la producción de los reflejos medulares. Usando al reflejo monosináptico por estiramiento como ejemplo, el autor explica la manera por la cual es regulado por los centros superiores. No se entra en la discusión de los reflejos polisinápticos tales como los reflejos flexores; sin embargo el autor señala que las vías descendentes influenciando la excitabilidad de las células de las astas anteriores pueden tener efecto sobre todos los reflejos espinales. El problema es de si puede interferirse un reflejo polisináptico en una sinapsis anterior a la motoneurona en el arco reflejo. La contestación a esta pregunta es importante no solamente para el mejor conocimiento de la regulación de los reflejos espinales sino para el entendimiento de los mecanismos envueltos en la trasmisión de los impulsos medulares aferentes.

### RIASSUNTO

L'autore tratta della modificazioni e della regolazione dei riflessi spinali da parte delle sezioni più alte del sistema nervoso. Per riflessi midollari si intendono quelli che si compiono in un midollo completamente separato dal resto del sitema nervoso, pur tenendo presente che tali riflessi posoono essere aboliti per la sovrapposizione di influssi tonici o per la mancanza di influssi favorenti da parte delle sezioni superiori. Servendosi come esempio del riflesso monosinaptico, che è abbastanza semplice, l'Autore spiega in qual modo esso sia regolato dai centri superiori. Non entra invece nella spiegazione dei riflessi polisinaptici, i flessori ad esempio, benchè le vie discendenti, capaci di influenzare l'eccitabilità delle cellule delle corna anteriori, possano avere effetto su tutti i riflessi spinali. Il problema verte sulla possibilità che un riflesso polisinaptico possa essere influenzato non soltanto alla giunzione del neurone motore ma anche in qualche altra sinapsi dell'arco riflesso. La risposta a ciò è importante non solo per una miglior comprensione della regolazione dei diflessi spinali, ma anche per comprendere i meccanismi in giuoco della trasmissione degli impulsi afferenti nell'interno del midollo.

# Spinal Echinococcosis

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ISTANBUL, TURKEY

ECHINOCOCCOSIS involving the central nervous system is rarely seen in European and North American countries. This condition is not infrequent in South America, Australia and Iceland. During my four-year period in St. Louis, in visiting many neurosurgical clinics, I never encountered a case of cerebromedullary echinococcus, nor has Dr. Roland M. Klemme of St. Louis, my former chief, mentioned one cerebral echinococcus in his whole collection. Dr. German of New Haven, Connecticut, stated one year ago that he and his associates had had 1 case, but it was not definitely proved. In 1952 Dr. Kean of the Department of Tropical Medicine of Cornell, while visiting Istanbul, was present when I removed a calcified hydatid cyst of the brain. He stated at that time that this type of lesion is very rare in the United States and suggested that I bring my personal collection to a future Congress. My former chief, Dr. Klemme, encouraged this suggestion.

This paper represents a series of cases of cerebrospinal echinococcosis that have come under my care in the past two and one-half years in Istanbul. Six cases, in 4 of which the brain was affected, and in the other 2 the spinal cord and spine, are here reported. This is an unusual number even in my country, and I am delighted to say that all the patients were surgically treated and the condition entirely cleared up.

According to recent statistics given by F. A. Yücell (Hastene N. 1, 1953) in a series of 3,670 autopsies performed in Bakirkoy Mental Hospital, only 4 cases of intracranial echinococcosis had been observed, and all of the deaths had resulted from this disease of the brain. In addition, the Department of Pathology of Istanbul University, in over 10,000 necropsies, did not encounter more than 3 cases of echinococcosis of the nervous system. At the time of writing I have not encountered any published case of spinal echinococcosis in the Turkish medical literature.

During the past fifteen years, in the First Surgical Clinic of Istanbul University, it has become evident that Turkey is one of the countries where echinococcosis is a common parasitic disease. Practically all of the patients have been seen by me, particularly those in whom the infestation was cerebral and spinal. The majority of patients with this condition usually have involvement of the liver and lungs and, less frequently, of other organs. In this series the central nervous system is the primary site, and no involvement of other organs was observed.

The echinococcus infesting the central nervous system is the larva of the Taenia echinococcus of dogs, cats and sheep. Ingested eggs of this taenia represent the embryonic stage of the parasite, which penetrates and perforates the intestinal wall. From there, via the blood stream and the lymphatics, it spreads to the different organs, usually by way of the portal stations in the liver, and develops the well known hydatid cyst. To reach other organs of the body the embryo of the parasite passes through the capillaries of the liver and lungs, which accounts for the rarity of the condition in other parts of the body. Dévé's statistics show that in no more than 1 per cent of cases were other organs involved, and Lombard's statistics show the incidence to be less than 3 per cent. In the greatest number of cases reported the condition [illegible] in Iceland, Australia and [illegible]

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bod). Henneberg reported the number of European cases of echinococcus infestation as less than 120. Morquio has collected 38 cases in twenty-five years. My series, collected in less than two and one-half years would suggest that the yearly incidence is twice that of Morquio's experience.

*Echinococcosis of the Spine and Spinal Cord (Spinal Hydatidosis).*—Two cases of spinal echinococcosis are here reported in which the patients were treated surgically by myself in the past two and one-half years. The Turkish medical literature at present would suggest that this condition has not appeared in the past. Consequently, spinal echinococcosis is a rarity even in Turkey. Purely intraspinal and intramedullary localization of the echinococcus is exceptional. In most cases one observes extramedullary, intradural or extradural, spinal or paraspinal localization of the hydatid cysts. Paravertebral soft tissues, muscles and vertebrae are involved and invaded by parasitic cysts and echinococcus lesions. In all cases of spinal echinococcosis in this series the spinal cord and meninges were involved and compressed directly by the cysts.

This spinal phenomenon appears in various forms. The hydatid cyst contains a clear fluid and numerous vesicles. Ordinarily the echinococcus is a multivesicular or mastic aseptic liquid surrounding the cyst. In Case 1, in which the lesion was removed from the lower lumbar region, the gross appearance of the surgical specimen simulated ground beef (Fig. 4). In Case 2, with the lesion in the upper cervical region, the appearance was that of systemic hydatidosis (Fig. 7). There were several cysts of different sizes and very little intercystic gelatinous material.

Spinal echinococcosis in the thoracic portion of the spine may involve the mediastinum, the pleura or the ribs as well as the paravertebral structures. Cervical echinococcosis involving the surrounding structures may simulate cystic tumor or, as in my second case, may strongly suggest malignant change. Careful differential diagnosis and study of the lesion are important. Lumbosacral echinococcus may involve the pelvic cavity and the parasacral tissues, which leads to difficulty in clinical identification of the parasitic lesion. As in my series, involvement of the spine is frequently polyvertebral. In some cases, especially in its incipiency, it may be univertebral. Affected vertebrae are infiltrated and destroyed by the parasitic cyst. Not infrequently the pathologic process involves only the lamina; both spine and transverse processes, as well as the vertebral body, may be intact. In the majority of cases there is a microvesicular or multicystic appearance, with small sequestrums. Interestingly enough, the ligaments, cartilages and capsules are well preserved. Evidence of vertebral osteitis (spondylitis) is extremely rare, and there is usually no reactionary bone formation. Vertebral or spinal deformities appear very late in the disease and may produce a gibbus or axial deformity of the spine (the so-called hydatid spondylosis deformans). Hydatid pachymeningitis is extremely rare. The meninges are usually intact, especially the dura.

*Pathogenesis.*—Although still a matter of controversy, spinal echinococcosis is generally supposed to originate from the vertebrae, the paravertebral structures or the spinal cord itself. Irrespective of the primary location the parasitic lesion will invade and involve the surrounding structures and the spinal cord, causing vertebral deformities, resultant medaullary compression and organic neural manifestations.

*Clinical Course and Symptoms.*—The symptoms of echinococcosis of the spine simulate those of extramedullary spinal tumor. The infestation manifests itself in its early stages by radicular pain associated with objective sensory and motor disturbances. Reflex changes and amyotrophic alterations in the peripheral nervous system associated with local tenderness at the level of the involved vertebrae, not infrequently combined with progressive rigidity of the spine, may often be confused with tubercular spondylitis or Pott's dis-

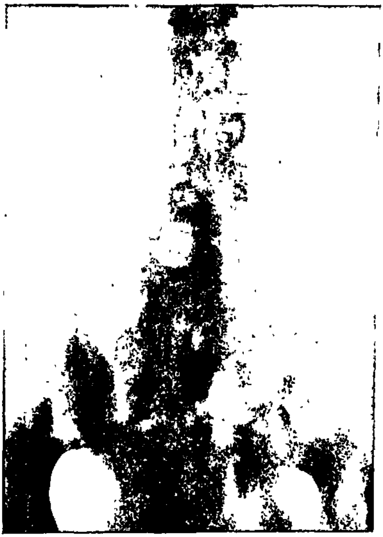

Fig. 1 (Case 1).—Roentgenogram showing lumbar kyphoscoliosis and advanced vertebral deformities.

ease unless extreme care is exercised. This is true particularly in those countries in which tuberculosis is a common disease. The most striking symptom, however, in the early stages of echinococcosis, are conservation of mobility, absence of deformity and rigidity of the spine, with sensory changes.

In my cases, despite the advanced lesions of the vertebrae, there were no apparent clinical signs of spinal deformity and no disturbances of mobility of the spine. In Case 1 the condition was thought to be *tubercular spondylitis, and in* Case 2 a spinal malignant tumor, by other members of the profession before the patients attended this Clinic.

Like other lesions involving or compressing the cord, as the echinococcus lesion advances organic neural changes appear distal to the site of the lesion. Paraplegia or quadriplegia with sensory and motor changes; sphincter disturbances; the Brown-Sequard syndrome; cauda equina, and conus syndrome are not infrequent. Intradural intramedullary spinal echinococcosis presents symptoms similar to those of central gliosis, syringomyelia or intramedullary tumors of the spinal cord. The foregoing symptoms are associated with median or paramedian painless tumor of the spine, which leads to the clinical diagnosis of spinal echinococcosis. Puncture of the cyst and microscopic examination of fluid confirms this diagnosis when the scolices of the parasite are identified.

*Roentgen Examination.*—Roentgen examination of the spine is important in the diagnosis of spinal echinococcosis. It reveals a rounded decalcified or punched-out area of unicystic or multicystic lesions. The intervertebral discs are usually well preserved, and there is no fusiform shadow of the spinal pattic abscess around the lesion. A myelogram is sometimes necessary and valuable to determine the exact location of the spinal block and to reveal the area of compression of the spinal cord.

*Biologic Tests.*—Spinal puncture, the Queckenstedt test and examination of the spinal fluid will reveal evidence of spinal block and confirm the diagnosis of impression of the spinal cord compression. Eosinophilia, the Weinberg and the intradermal reaction of Casoni are specific biologic signs of hydatidosis if they are positive. Unfortunately these tests frequently give negative, results, as occurred in my cases.

*Treatment.*—Treatment of echinococcosis of the spine is unquestionably surgical and should not be delayed. To obtain good results it is essential to establish an early diagnosis. The prognosis is poor and recurrence to be expected if treatment is delayed. If an intradural intramedullary echinococcus cyst exists, a posterior midline myelotomy is necessary to remove it. Radical operation with complete removal is possible, and a [illegible] cure [illegible] expected. Injectic [illegible] ion [illegible] hyde into the [illegible] formalinization of the region immediately after the operation has been considered a preventive measure to avoid a possible recurrence.

In my 1 case of echinococcosis of the lower lumbar portion of the spine the operation was so extensive that fusion of the spine was necessary. Fortunately this did not obtain in the case in which the cervical portion of the spine was involved. At the time of writing, the evidence points to a cure in both cases.

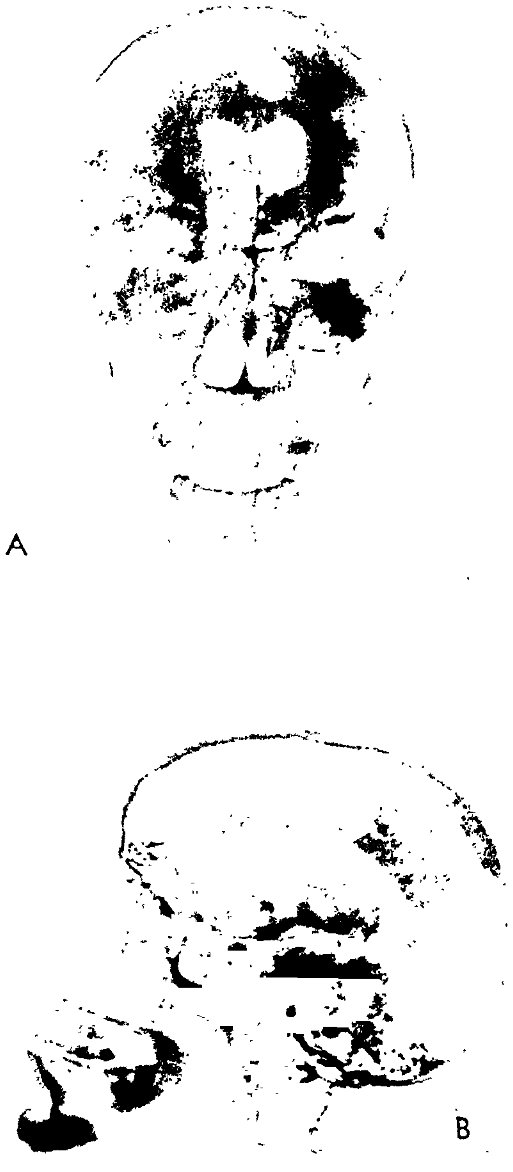

Fig. 2 (Case 1).—Anteroposterior (*A*) and lateral (*B*) encephalograms. Slight dilatation of the left lateral ventricle is apparent (see text).

### REPORT OF CASES

Case 1.—N. F., a housewife 40 years of age, was admitted to the First Surgical University Clinic in February 1951, with combined paraplegia and right hemiplegia (triplegia), anesthesia below the umbilicus, sphincter disturbances and speech dysarthria, with emotional instability.

The history, obtained from relatives, revealed that the present illness had started with a bilateral sciatic pain and paresthesia of the lower extremities approximately three years prior to admission. The condition became gradually worse, and the patient was unable to walk because of paraplegia, with sensory loss and sphincter disturbances that developed at the end of second year, when she became totally bedfast. She was treated as a Pottic patient and was transferred to the Orthopedic Clinic for a checkup. While she was in the hospital there occurred a vascular cerebral accident, with aphasia and right hemiplegia. Operation was postponed on account of this unexpected complication, and the patient was discharged and taken home in this helpless condition.

Examination revealed a typical cauda equina syndrome combined with right hemiplegia, speech dysarthria and emotional instability due to a previous left cerebral vascular accident. The primary lesion was in the spine and spinal cord, as the history showed clearly. It involved the lower lumbar portion of the spine, causing a typical cauda equina syndrome with motor and sensory paralysis below the hip, sphincter disturbances and arriflexia. The cerebral accident, occurring later in the course of the spinal disease, complicated the picture.

Roentgen examination showed multiple microcystic and macrocystic lesions of the lower lumbar and upper sacral portions of the spine, characteristic of spinal hydatidosis. The lower portions of the third, fourth and fifth lumbar and the upper sacral vertebrae had been partially destroyed by the cystic lesions. There was an enormous geode between the third and fourth lumbar vertebrae. Lumbar kyphoscoliosis and advanced deformities of the vertebrae were apparent in the roentgenograms (Fig. 1).

A myelogram showed a definite block at the third lumbar vertebra above the lesion.

Biologic tests (Casoni, Weinberg) gave negative results. There was no marked eosinophilia and no change in the blood picture and cell count.

*An encephalogram showed slight dilatation* of the left lateral ventricle, possible due to *cerebral cortical atrophy, and intracranial* traces of lipiodol in the base of the skull. There was no evidence of shifting or compression of the ventericular system. The spinal fluid was clear, and laboratory analysis revealed no abnormalities except moderate elevation in the protein content (0.75, Fig. 2).

In spite of the negative biologic reactions the clinical and roentgenologic signs strongly suggested spinal echinococcosis of the lumbosacral region, and the patient was taken to the operating room with this diagnosis on March 8. Operation was performed with the patient under general anesthesia (Kemithal, ether and oxygen). A midline incision was *made in the lumbosacral region, and laminec*tomy was carried out in usual manner. Between the laminae of the fourth and fifth lumbar vertebrae small echinococcus cysts were protruding. The third, fourth and fifth lumbar laminae were removed; thousands of small echinococcus cysts with intercystic jelly-like substances were taken out; the area was carefully cleaned, and formaldehyde was applied. The gross specimen of these cystic lesions was exactly similar to ground beef (Fig. 3). The dura was opened, and no intradural extension or infiltration of the lesion was observed, but the dura was thickened in this region and the cauda equina greatly compressed.

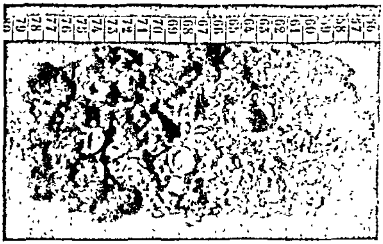

Fig. 3 (Case 1).—"Ground beef" appearance of gross specimen.

The fourth lumbar vertebra had been almost completely destroyed by the cystic lesion. This necessitated a bone graft and spinal *fusion*.

The postoperative course was long and the patient remained in the hospital for three months in a plaster cast, after which she was discharged to continue physical therapy for further improvement. At the time of her discharge she had regained control of the sphincters. There was marked improvement in the control of her legs.

CASE 2.—H. E., a farmer, 46 years old, was admitted to the Neurological University Clinic on *Oct. 12, 1951, with a complaint of severe* radiating pain in the arms and major weakness in the legs. His illness had started one year earlier with a dullness in the hands that gradually increased and was associated with radiating pain in both shoulders and arms. Three months prior to admission motor weak-

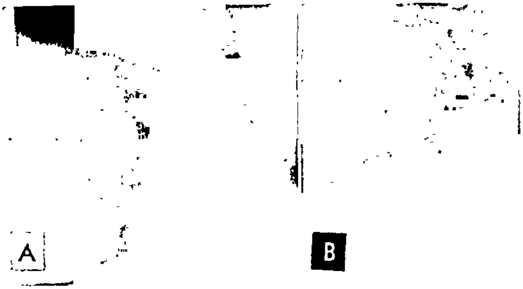

Fig. 4 (Case 2).—*A*, roentgenogram showing decalcification and partial destruction of second and fourth cervical laminal and spinous processes. *B*, myelogram showing complete block of contrast medium between second and third cervical

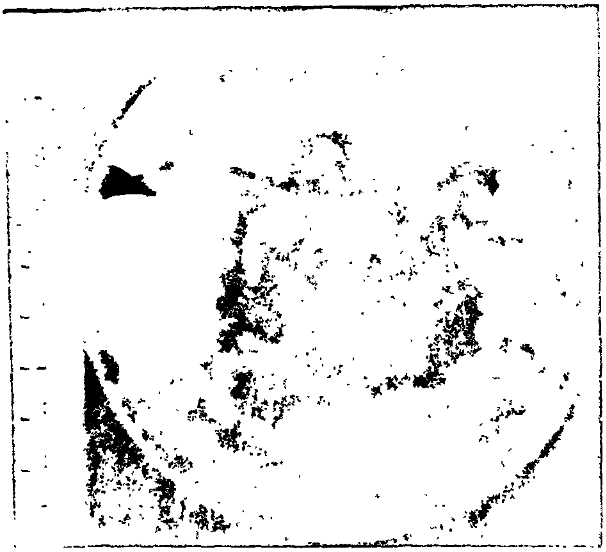

Fig. 5 (Case 2).—Echinococcus cysts packed in operative area, causing extradural compression of cord.

ness had developed in the upper and lower extremities, and walking became difficult. No sphincter disturbances occurred during the course of the illness. While the patient was in the Neurological Clinic his condition became increasingly and rapidly worse; he was soon confined to bed and unable to feed himself because of complete quadriplegia.

A tumor mass deep in the cervical region, extending to the right supraclavicular area, appeared and became palpable. Because of its consistency and immobility, the diagnosis of possible malignant tumor involving and infiltrating the upper cervical portion of the spine and resulting in spinal cord compression was made, and the patient was transferred to the First Surgical Clinic for operation on October 20.

Physical and neurologic examination revealed an upper cervical paramedian tumor, deep-seated and immobile, extending to the right supraclavicular region but causing no limitation of the mobility of the cervical position of the spine. There was no local tenderness to pressure and palpation. The tumor mass was hard and was about the size of an orange.

The patient was unable to walk or to feed himself because of spastic quadriplegia. Dynamometric examination of the power of the

Fig. 6 (Case 2).—Posterior (A) and lateral (B) postoperative views of patient.

hands showed a decrease of 50 per cent in the right and 40 per cent in the left. Sensory examination revealed hypethesia and hypalgesia, with markedly decreased vibratory reception and deep sensation below the fifth cervical dermatome. A typical Horner's syndrome was visible on the right. The cutaneous reflexes were abolished bilaterally. The deep tendon reflexes were increased, clonus +, Babinskis were indifferent, Hoffman + bilaterally. There was no evidence of sphincter disturbances.

Repeated Wassermann and Kahn tests of both blood and cerebrospinal fluid gave negative results.

Spinal fluid: Clear — initial pressure 350 (Claude)
Lymphocytes 0.8
Protein 1.42
Chloride 7.94
Pendy +++
Nonne ++
Weichbrodt ++
Sedimentation
½ hr.—6 mm.
1 hr.—10 mm.
2 hr.—28 mm.
R.B.C. 4,000,000
W.B.C. 6,400
V.G. 84%. no eosinophilia
B. Colloidal—001122 222000

The Queckenstedt test showed complete block. Roentgen examination showed decalcification and partial destruction of the second and fourth cervical laminae and spinous processes (Fig. 4*A*).

A myelogram revealed complete block between the second and third cervical segments (Fig. 4*B*). The results of biologic tests were negative.

With the patient under general anesthesia (Kemithal, ether and oxygen) an upper cervical laminectomy was carried out in the usual manner. Between the spinal processes and the posterior arches of the second and third cervical vertebrae a typical enormous hydatid cyst was protruding. The laminae of the third and fourth cervical vertebrae, and part of that of the second, were removed and the echinococcus cysts carefully taken out. There were several hundred cysts of various sizes, packed in the area and causing spinal cord compression extradurally (Fig. 5). The dura was intact. A careful intradural exploration was made after the cysts had been completely removed. The region was formalinized, and the dura and the wound were closed in layers (Fig. 6).

The postoperative course was uneventful. The patient made a quick recovery, was up and about on the fifteenth postoperative day and was discharged one month after the operation, fully recovered.

*Histologic examination of the surgical* specimen confirmed the operative diagnosis. In this case the echinococcus cysts were entirely similar to the classic form of systemic echinococcus cysts and did not contain intercystic jelly-like substance as in the first case.

## *SUMMARY*

Echinococcosis of the central nervous system, a comparatively rare condition, is discussed as to geographic incidence, pathogenesis, diagnosis and treatment. Six cases, in 4 of which the brain was affected and in the other 2 the spine and the spinal cord, were encountered by the author at the University Medical Clinic of Istanbul. Two cases are reported in detail.

Treatment, i. e., surgical intervention, should not be delayed. Good results require early diagnosis and prompt treatment. If operation is postponed, the prognosis is poor and recurrence is to be expected.

## DISCUSSION BY DR. ROLAND KLEMME, ST. LOUIS

DR. KLEMME: I had the good fortune to visit Dr. Feyyaz Berkay's Clinic, and I was particularly impressed by the number of parasitic lesions encountered in Istanbul. Amebic abscesses of the liver and lung seemed extremely common. Solitary tuberculoma of the brain was very common, and Dr. Berkay was good enough to operate on several patients while I was there. We entered into a lengthy discussion on parasitic conditions of the central nervous system. As a result of these discussions I insisted that Dr. Berkay appear before this group and tell us some of his exper ences.

In all my years of practi

1 echinococcus cyst of the brain, in a child 9 years of age, with complete recovery. One other patient, 38 years old, had multiple parasitic cysts of the brain, first diagnosed as infectious granulomas, probably due to taenia mycosis. Later after further examination, it turned out to be due to a parasite that is fishborne in the northwestern portion of the United States. The identity of the parasite was never established.

This presentation today is a most striking one. Our guest speaker in two and a half years has had the misfortune or good fortune, whichever you choose to call it, of seeing more parasitic cysts of the central nervous system than have been reported in his country in over fifteen years. The thing that is more impressive, however, is the value of sanitation, good horticulture and animal husbandry which we enjoy in this country, as compared to the countries in the Near East. Certainly, if any members of the audience are genuinely interested in seeing parasitic conditions and tuberculoma of the central nervous system, a visit to Dr. Berkay's Clinic in Istanbul would pay for itself many times over. Dr. Berkay's discussion is very timely in this day of potential global warfare. When our countrymen are scattered all over the world we should be better acquainted with common conditions in countries other than our own, in the event we are confronted with this type of clinical picture.

## CLOSING REMARKS BY DR. BERKAY

DR. BERKAY: Basically, between intracranial and spinal echinococcosis there is no difference in the cysts. With spinal echinococcosis there is usually intercystic jelly or mastic substance, as in one of my cases. The intracranial echinococcus lesion is more commonly a unicystic or multicystic form that does not contain intercystic jelly. In the past two years I have had the opportunity to operate on 4 patients with cerebral echinococcus. In 3 of these the lesions were enormous single cysts; in only 1 of the 4 was multicystic hydatidosis of the brain observed. In this case I removed 105 small cysts from the frontal-parietal area of the brain. In these 4 cases the lesions were subcortically located, and 1 of them was a calcified hydatid cyst deeply seated in the parietal lobe. One of the most prominent symptoms of the cerebral echinococcus cyst is the convulsive seizure that was present in all my cases. All of the patients were surgically treated, with good results and no recurrences.

An outstanding characteristic of the spinal echinococcus cyst is that, in the majority of cases, the cysts are extramedullary and extradural. They originate primarily from the vertebrae or the paravertebral structures and involve the spinal cord secondarily. Intramedullary spinal echinococcus cysts are exceptional. Intracranial echinococcus cysts are more frequently primary intracerebral subcortical lesions, and those originating from the skull and involving the brain secondarily are rare, even exceptional.

## ZUSAMMENFASSUNG

Die Echinokokkuserkrankung des Zentralnervensystems, eine verhältnismässig seltene Erkrankung, wird in Bezug auf geographische Verbreitung, Pathogenese, Diagnostik und Behandlung erörtert. Der Verfasser sah in der Medizinischen Universitätsklinik von Istanbul sechs Fälle, von denen vier die Erkrankung im Gehirn und die übrigen in der Wirbelsäule und im Rückenmark aufwiesen. Zwei Fälle werden im einzelnen dargestellt.

Die Behandlung, d. h. der chirurgische Eingriff, soll nicht verzögert werden. Gute Erfolge hängen von frühzeitiger Erkennung und sofortiger Behandlung ab. Aufschub der Operation verschlechtert die Prognose und mag zu Rückfällen Anlass geben.

## RÉSUMÉ

On discute la pathologie géographique, la pathogénie, le diagnostic et le traitement de l'échinococcose du système nerveux central (rare). L'auteur décrit quatre cas d'échinoccose médullaire qu'il a observés à la Clinique universitaire de médecine d'Istamboul. Deux cas sont rapportés en détail. Traitement : l'intervention chirurgicale ne doit pas être différée. Seul un diagnostic précoce et un traitement rapide donnent de bons résultats. Si on retarde l'intervention, le pronostic est mauvais et on doit s'attendre à des récidives.

## RESUMEN

La equinococcia del sistema nervioso central es un padecimiento raro. Se discute su incidencia geográfica, patogenia, diagnóstico y tratamiento. En la Clínica Médica Universitaria de Estanbul, el autor encontró 6 casos, de los cuales en 4 se encontraba afectado el cerebro y en 3 la médulla y la columna vertebral. Se comunican 2 casos en detalle.

El tratamiento ó sea la intervención quirúrgica no debe demorarse. Se requiere para la obtención de buenos resultados, diagnóstico precoz y tratamiento inmediato. Si se pospone la operación se enpobrece el pronóstico y es de esperarse la recidiva.

## RIASSUNTO

E' un lavoro sull'echinococcosi del sistema nervoso centrale, malattia rara, di cui vengono studiate la distribuzione geografica, la patogenesi, la diagnosi, la cura. L'autore, nella Clinica Medica dell'Università di Istanbul, ne ha osservati 6 casi: in 4 era interessato il cervello, negli altri la colonna vertebrale ed il midollo spinale. Due casi vengono descritti dettagliatamente. La terapia è chirurgica, e non deve essere rimandata nel tempo. Per ottenere buoni risultati sono necessarie una diagnosi precoce ed una pronta terapia, altrimenti la prognosi è cattiva e possono verificarsi recidive.

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The notion that the physician or surgeon of today is wiser or safer than his forerunner simply because he has been dowered with a bewildering array of strange paraphernalia is to be not only emphatically denied, but militantly opposed. Unless he happens to be wise and careful by nature, the fruits of medical science are likely to make him all the more dangerous. The fruits of science are always spoken of as if they were invariably beneficent. They are no more so than the phenomena of nature. The water of the river is a phenomenon of nature; it will cleanse you or drown you with equal imperturbability.

—*Clendening*

# Physiologic Mechanisms of Spinal Shock*

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AND

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IT would seem imprudent for use at this time to review methodically the carefully documented work from 1833 to 1934 on spinal shock. Mere mention will be made to give credit to outstanding investigators on the way. Even the definition will bear little in the way of alteration, although we should like to mention it for its possible use in the course of discussion: a transient state of reflex depression occurring caudal to a lesion producing spinal transection. Certainly the condition of spinal shock *per se* deserves little in the way of study, for its foreboding presence is known only, with awe and alarm, to the clinician. However, as a mechanism causing temporary cessation of reflex activity and synaptic function with the gradual return and blending to a state of heightened activity, it is of extreme interest. It seems worthy of investigation, therefore, mainly as a pattern of action which, if understood, may facilitate insight into other patterns of action occurring at other levels to the nervous system. Eccles and McIntyre[1] define plasticity as the ability of individual synaptic junctions to respond to use and disuse by appropriate changes in transmissive efficacy. The mechanism of plasticity has been postulated by Konorski,[2] Penfield[3] and others as possibly underlying memory processes, and Eccles and McIntyre[1] have gone on to show that plasticity occurs even in the simplest of reflex arcs, namely, monosynaptic. It is not illogical, then, to carry over this concept to account for the eventual state of spasticity observed after spinal shock. Also, as others have noted, a period of cerebral shock frequently follows removal of large amounts of brain substance. This may be characterized by some loss of normal thought processes, memory and even consciousness. Yet to a remarkable extent, over a period of weeks, possibly through adaptation or plasticity, there is usually gradual return of function. To carry the analogy another step, we even have release mechanisms available on a cerebral basis, as after removal of an atrophic hemisphere,[4] that mimic to some extent the exaggeration of reflex activity of the forelegs observed in the Shiff-Sherrington phenomenon after spinal section. Thus, it seems to us that the mechanism and pattern of spinal shock are worthy of continued investigation in an effort to understand the delicate interplay that accounts for reflex diminution and accentuation and may explain similar phenomena at so-called higher levels of synaptic function.

*Historical Summary.* — Marshall Hall[5] is generally credited with first describing spinal shock in 1833. Not only did he describe it, but he made the observation that it is increasingly severe as one ascends the phylogenetic scale. Important contributions along the way were the description of the Shiff-Sherrington phenomena in 1898, and correction of the erroneous theories of Bastian[6] and Goltz[7] by Sherrington.[8] Bastian had confused the concept of surgical and spinal shock, theorizing that they were the same, whereas Goltz proposed the hypothesis that spinal

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shock was due to inhibition from descending impulses from the region of the transection.

In 1924 McCouch[9] demonstrated an increase in the flexion reflex following spinal transection on the side opposite that of previous motor cortex ablation, thus emphasizing the essential role of the pyramidal tract. Fulton, Liddell, and Rioch[10] in 1930 presented evidence showing that the vestibulospinal paths are largely responsible for the changes in the knee jerk following spinalization of the decerebrate animal. In 1940 Van Hareveld[11] advanced a theory that spinal shock actually depends on the dominance of a spinal inhibitory mechanism. This was based on the prompt onset of extensor rigidity after asphyxia following transection. This theory in turn is, of course, based on the fact that normal tone of the spinal cord is maintained by dominance of the downstream facilitative mechanism, which, as Sherrington showed, when obliterated by spinal transection completely releases the lower part of the cord from the influence of these higher centers. *Hence, there is no great argument thus* far among physiologists as to the actual condition prevailing at a cord level. As Sherrington has expressed it, there is a release of the segmental levels from the facilitatory action of the higher centers of the brain stem.

In addition, there is a strong spinal inhibitory mechanism, as shown by the increase in reflex excitability in the upper limbs when the cord is transected below the brachial enlargement. The precise site of spinal shock with regard to specific structures, as well as the mechanism of recovery, remains largely unknown. The brief definition given in an earlier paragraph fails, in many ways to describe the phenomena clearly. Moreover, it fails to account for, or to specify the duration of, areflexia and hyporeflexia. Also, it does not distinguish between a partial and a complete transection, or between an anatomic or a physiologic transection. However, it is now realized that in order to produce a stage of complete spinal shock it is not necessary to perform an anatomic transection. Under such conditions we describe this as physiologic transection, due to concussion or contusion of the cord.

From the human point of view, in high cervical physiologic transections occurring between the fifth and the sixth or the sixth and the seventh cervical vertebrae we have observed the following characteristics of high spinal transection: (a) depression of the pulse rate and, often, depression of respirations; (b) hyperthermia; (c) a drop in blood pressure; (d) complete loss of the autonomic reflexes, including those of the bladder and bowel; (e) slight plantar flexion of the great toe, elicited by stimulus on the plantar surface and occurring between four and eighteen hours after the injury;* (f) presence of the cremasteric reflexes or their recovery next to the plantar-flexor reflex; (g) recovery of the achilles tendon reflex in advance of recovery of the quadriceps reflexes, and (h) a tendency of the tendon reflexes to recover before the bowel and bladder reflexes had recovered.

*Some of these data have been noted recently by others,[12] and it is merely to cor*roborate and reiterate the conditions associated with acute spinal shock in the human being that we mention them. In spite of disagreement over the mechanism and site of action of acute spinal shock, there are some points upon which there is generalized agreement. These are as follows:

1. There is a marked phylogenetic effect, so that generally the severity of spinal shock is increased as one ascends the evolutionary scale.
2. There is an initial period of reflex loss, measured in terms of seconds in lower forms and in terms of hours in man, with a gradual return of reflex function, eventually to a hyperactive stage.
3. There is both an earlier and a more

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*This plantar reflex became fatigued very rapidly and it [illegible] could only be elicited by a slight scratch over the fl [illegible] surface of the toe. Thus, it exhibited e [illegible] eme local [illegible] and seemed to be present w [illegible] s were seen.

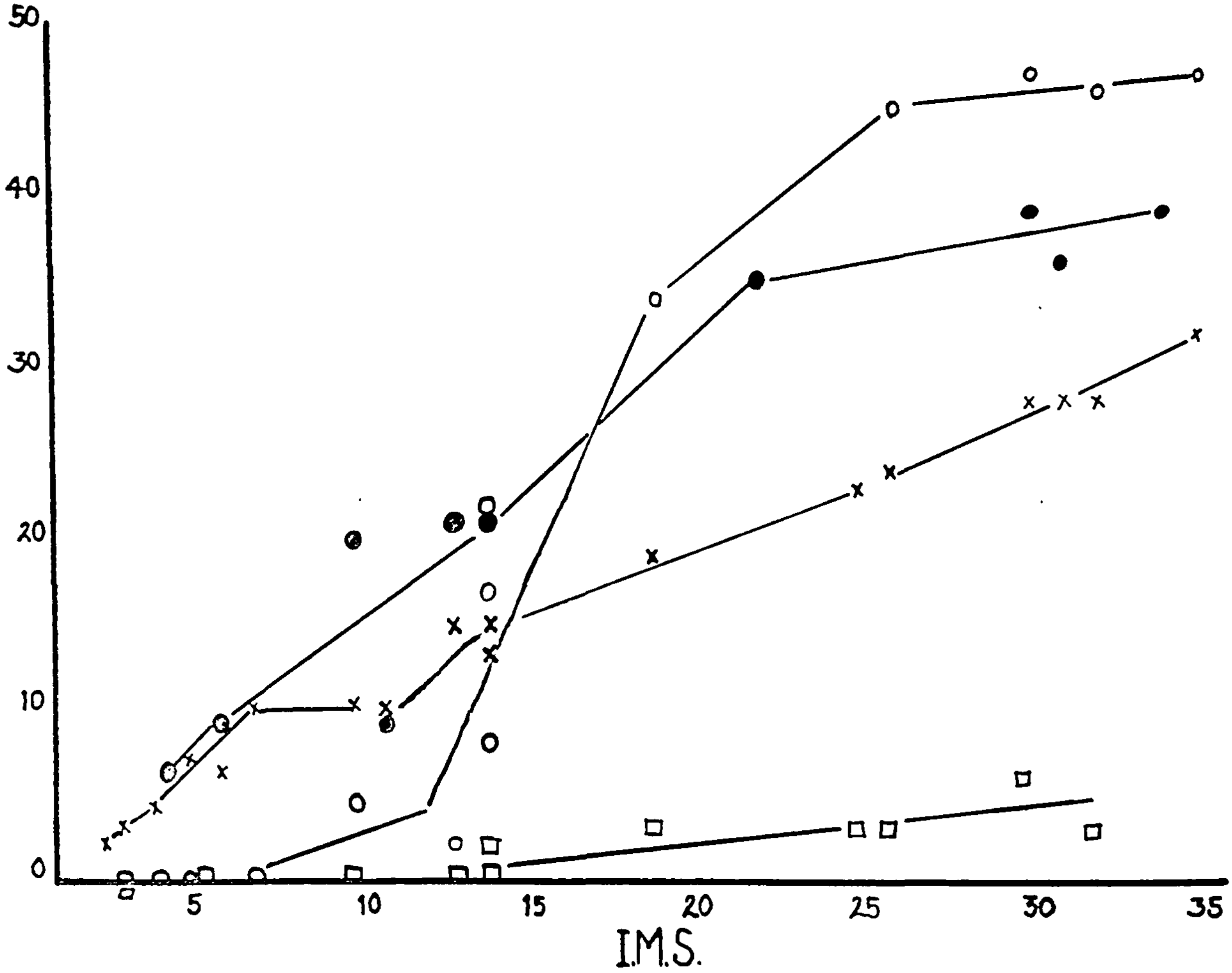

Fig. 1.—Decerebrate cat. Shows the development of the monosynaptic reflex (circle) the polysynaptic reflex (square) the dorsal root reflex (black dot) and the $N_1$ wave (×) of the negative intermediary potential with stimuli of increasing strength applied to the seventh lumbar dorsal root. The amplitude of these recorded factors is plotted on the ordinate against the amplitude of the intramedullary spike I.M.S. on the abscissa. Recording electrodes on the dorsum of the cord and on the seventh lumbar ventral root.

complete recovery of reflexes in lower forms, often sufficient to permit ambulation of different degrees.

4. In mammals the flexor reflex recovers first and eventually becomes exaggerated. Likewise, there is a tendency to recovery of the peripheral reflexes in advance of the proximal.
5. Generally the recovery of somatic reflexes precedes that of autonomic reflexes.
6. There is a much earlier and more complete recovery of function and reflex activity in immature animals.
7. In a progressive type of spinal transection in man, that is, one occurring over a period of some two weeks, there is no true spinal shock but a gradual transition to spasticity.
8. During recovery in mammals there is a gradual transition from hyporeflexia to hyperreflexia.
9. After recovery from spinal shock there is no secondary spinal shock if the cord is again transected just below the level of the original lesion.

Previous work by McCouch, Stewart, and Hughes[13] had shown that changes occur in both the negative intermediary potential and the positive intermediary potential in the presence of acute spinal shock. In the opinion of these authors,

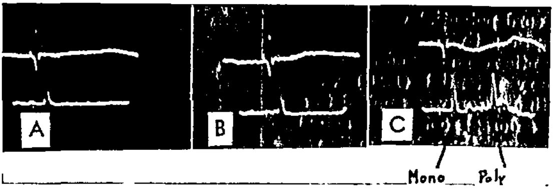

Fig. 2.—Records of cat in acute spinal shock (Jan. 2, 1953): stimulus, 0.8 volt to nerve from gastrocnemius. Upper record, dorsum of cord; lower record, seventh lumbar ventral root. *A* and *B*, decerebrate; *B* after curare, *C* after transection of cord.

they had demonstrated that the site of action in the presence of spinal shock was predominantly internuncial in the cat, while in the monkey there was in addition to internuncial depression, some shocklike effect on cells in the ventral horn. Because of improved instrumentation and technics, they concluded that further study of spinal cord and ventral root potentials might yield additional information concerning the mechanism of spinal shock.

*Methods.*—Decerebrate cats and monkeys were studied before and after acute midthoracic spinal transection. All animals were decerebrated under ether and allowed a minimal period of one hour before recording was begun which has previously been shown to be adequate.[14] Spinal transection was carried out with the animal under divinyl ether anesthesia, or, more frequently, under anesthesia induced by small intravenous doses of D-tubocurarine, 0.22 mg. per kilogram of body weight. The dose of D-tubocurarine was small enough so that control cord and ventral root potentials taken before and after its administration showed no changes.

Routinely, the lumbosacral cord was exposed and an appropriate dorsal root or nerve selected for stimulation. Potentials were then recorded from the surface of the spinal cord, the dorsal root and/or the ventral root. The dura was opened under warm Ringer's solution, and the cord and roots thereafter covered with warm mineral oil. Surgical shock was prevented by the administration of 40 to 80 cc. of intraperitoneal Ringer's solution.

*Results and Comment.*—Prior to transection in the decerebrate animal, the monosynaptic response appeared at threshold whether a muscle nerve, a mixed nerve, or a dorsal root was stimulated. A small polysynaptic response often appeared as one approached maximum stimulation strength. Also, it is interesting to note that a small $N_1$ wave was always

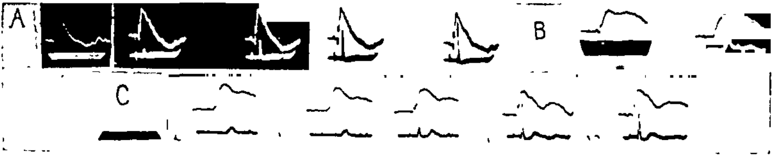

Fig. 3.—Baby macaca irus (Jan. 9, 1953). Stimulus to peroneal nerve. *A*, decerebrate; at volts 1, 0.4, 0.6, 0.8, 1; seventh lumbar ventral root recorded. *B*, spinal; at volts 1.4; seventh lumbar ventral root recorded. *C*, spinal; at volts 0.8, 1, 1.4, 1.8, 2; sixth lumbar ventral root recorded. Time, 1,140 cycles. The top sweep records the cord potential and the bottom sweep the ventral root potential in each record. In row *A* it is noteworthy that there is little if any polysynaptic response, while in row *C*, after spinal transection at midthoracic level, there is now a large po pti ponen which is the threshold response.

present in the cord potential with the onset of polysynaptic activity.

The polysynaptic response and the negative intermediary potential (NIP) were larger if the stimulation was applied to a mixed nerve or a dorsal root. After spinal transection, however, the polysynaptic response was either the threshold response or appeared simultaneously with the monosynaptic. Again this reflex was associated with a negative intermediary potential that remained smallest in the case of the muscle nerves.

Figure 1 shows the growth of monosynaptic and polysynaptic reflexes plotted against height of the intramedullary spike (IMS) in the decerebrate cat. In addition, we also show the dorsal root reflex and $N_1$ developing as the amplitude of the intramedullary spike increases in response to stimulation of the seventh lumbar dorsal root.

Figure 2 illustrates the change in response from monosynaptic to polysynaptic following spinal transection as one stimulates the nerve to the gastrocnemius muscle. This figure shows that the minimal dose of curare used for immobilization does not alter the cord or ventral root potential. It also shows that stimulating a muscle nerve yields a poor $N_1$ potential even after the appearance of the polysynaptic reflex. The change in threshold response from monosynaptic to polysynaptic is displayed in Figure 3. There has been a slight change in position of the electrode on the surface of the cord at the time of spinalization, and this accounts for the decrease in amplitude of the intramedullary spike.

When facilitation and inhibition were tested before and after spinalization a marked change occurred. This is shown where the monosynaptic response from

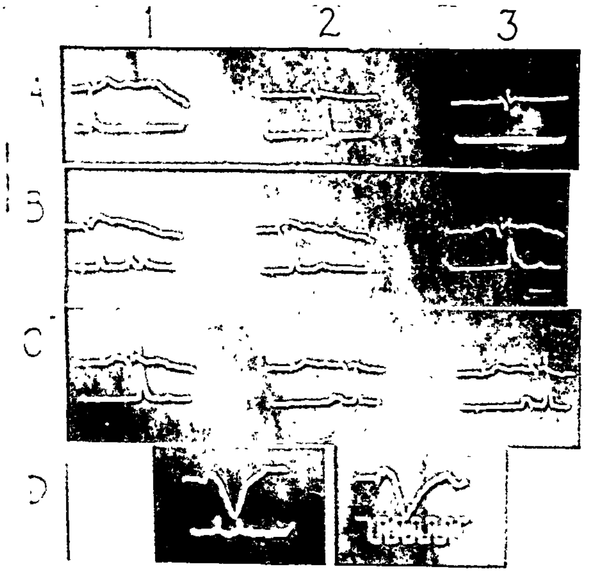

Fig. 4.—Decerebrate cat. Test response is shown in A1. Top sweep is cord potential and bottom sweep is ventral root potential following stimulation of gastrocnemius nerve and recording from [illegible] lumbar segment. Conditioning response [illegible] stimulation of internal saphenous nerve [illegible] as recorded from the *dorsal root* [illegible] is 1,140 cycles. Rows *B* and *C* show [illegible] of the nerves at increas[illegible] after *B1* facilitated. Row *D* shows [illegible] at a slow sweep (60 cycles) [illegible] internal saphenous nerve.

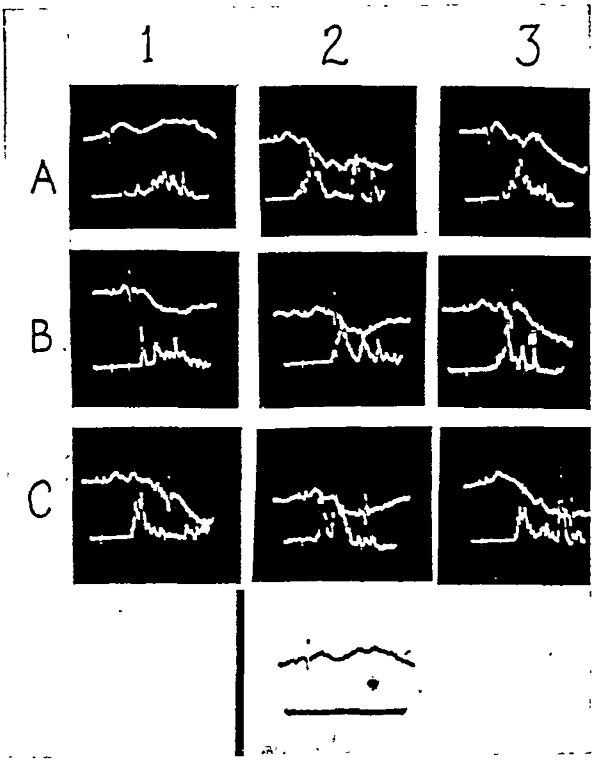

Fig. 5.—Conditioning effect of internal saphenous on gastrocnemius after acute spinal transection. The effect is the reverse of that observed in decerebration. In *A1* is the test response and in *A2* the conditioning response. *A3* shows early facilitation, but all subsequent pictures show inhibition of the monosynaptic test reflex at increasing separate distances.

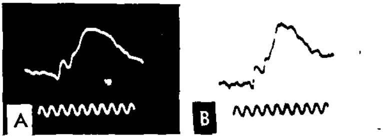

Fig. 6.—Effect of spinalization on the negative intermediary potential, with increased discreteness of $aN_1$. Baby macaca irus (Jan. 7, 1953) curarized; stimulus to peroneal nerve. *A*, decerebrate; *B*, four minutes after transection of cord.

the gastrocnemius nerve is conditioned by a volley from the internal saphenous nerve in both the decerebrate and the spinal state. Figure 4 shows that, in the decerebrate cat, the monosynaptic reflex from the gastrocnemius is inhibited for the first few milliseconds and thereafter strongly facilitated for at least thirty to forty milliseconds. After spinalization (Fig. 5) the effect is reversed, there being an initial facilitation for a few milliseconds and thereafter a rather prolonged depression or inhibition of the monosynaptic response. These results appear to be in keeping with the general observations made on animals, namely, that in the decerebrate state there tends to be an exaggeration of the extensor monosynaptic response (stretch reflex) and in the spinal state a depression thereof.

The alterations in the $N_1$ part of the cord potential are more pronounced in the monkey than in the cat after spinalization, as is, of course, spinal shock. Briefly, the changes we have observed in the negative intermediary potential following spinalization of the decerebrate and unanesthetized animal are as follows:

1. Prolongation of the negative intermediary potential, with rounding out of $N_1$ and $N_2$; generally this change seems best described by the term "desynchronization." It is somewhat transient and is more marked in the monkey than in the cat.
2. A transient depression of the positive intermediary potential, or so-called P wave. This is also more marked in the monkey.
3. The appearance, or an increase in the discreteness, of a small wave on the rising phase of $N_1$, hereafter called $aN_1$.

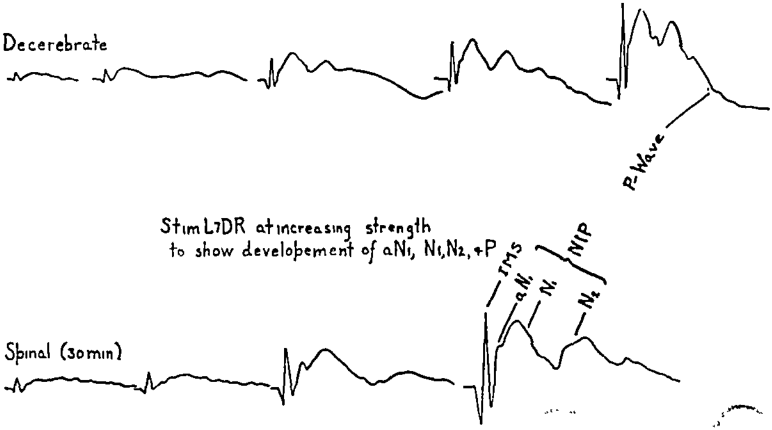

Fig. 7.—Development of the cord potential with increasing strength o and af spinal section.

The so-called desynchronization of the negative intermediary potential and the emphasis of a separate wave, $aN_1$, on the rising phase of $N_1$ is seen in Figure 6. This is shown in a series of stimuli of increasing strength in Figure 7. These records were obtained by tracing the separate projected negatives.

From these results obtained after spinalization it seemed to us that $aN_1$ and the remainder of $N_1$ proper could represent separate pools of interneuronal response. However, subsequent data obtained from asphyxial and conditioning experiments have shown that $aN_1$ behaves in a fashion similar to the intramedullary spike and unlike the remainder of $N_1$.[15] For this reason we have chosen to interpret $aN_1$ as presynaptic. This suggests that one of the effects of desynchronization is to fractionate the negative intermediary potential with presynaptic and postsynaptic components.

### DISCUSSION BY DR. J. LAWRENCE POOL, NEW YORK

DR. POOL: I have been most impressed by the physiologic studies just reported, which in my opinion mark a great step toward understanding of the mechanisms of spinal shock. Indeed, this is about the only way in which we can hope to understand the physiologic disturbances in the spinal cord after injury or disease resulting in a transection. It does not seem to me, however, that the animal studies reported necessarily duplicate the condition in man during the period of spinal shock characterized by areflexia and flaccid paralysis that usually lasts several weeks after transection of the human spinal cord.

The studies of electrical changes in the cat and monkey cord after transection indicate enhancement of the polysynaptic responses. This suggests a state that would more probably resemble the condition in man when the period of "spinal shock" has ended and hyperreflexia, with involuntary or "spastic" movements, supervenes.

I should therefore like to ask the speakers whether they correlate their results with the clinical state of true spinal shock in man, or with the later state of hyperreflexia and "spasticity" that usually follows spinal shock.

### DISCUSSION BY DR. CHANDLER MCBROOKS, BROOKLYN

DR. MCBROOKS: In discussing this paper on the mechanism of spinal shock it is pertinent to point out that all general body reactions are due to an interplay between higher and lower integrative centers.

It is an orthodox physiologic concept that these lower centers have acquired so much dependence upon directives from above that, when connections with higher centers are cut off, total inactivity or spinal shock results for a time.

It can also be said that there are two types of integrating or spinal response mechanisms: the two-neuron arc or monosynaptic reflex pathway, and the polysynaptic pathway. Higher centers act upon both. What is the peculiar functional significance of each?

The monosynaptic reflex is in integral part of the antigravity system. It, however, seems to have a modulator action, whereas the polysynaptic pathways are essential to purposive, effective or complex responses. These monosynaptic reflex responses are initiated by activity in progress, such as stretch imposed on muscle by gravity, and they break through other activities to check or reenforce a movement.

In some ways it is surprising that Dr. Austin has noted lower thresholds for and dominance of the polysynaptic reflex after cord section. The monosynaptic pathway characteristically is less susceptible to block by anesthetics, by such drugs as myanesin, by asphyxia, etc. As a matter of fact, the reflex responses to tapping of tendons, which are among the early signs of recovery from spinal shock, are monosynaptic responses. In my opinion, any lessening of prominence of the monosynaptic reflex in spinal animals is due to (1) absence of facilitative action of higher "antigravity centers" and/or (2) overaction of the polysynaptic reflexes caused early by irritation from the site of cord section and later by release of these polysynaptic complexes from higher integrative control. A high background of polysynaptic activity has an inhibitory action on the monosynaptic pathway. This question of relative dependence of the two types of reflex on higher centers is of interest and deserves continued study.

Dr. Austin is to be commended for his effort to determine what is actually happening in the spinal cord during reflex activity. This is a difficult procedure. Interpretation of the complexities of cord potentials is one of the standard methods of obtaining information. One of the major problems is to determine whether a material or a condition acts upon terminals of an axon at a synapse or upon the neuron somas near or on which they terminate. His argument that the $aN_1$ potential is given by the afferent terminals and is less affected by asphyxia than the $N_1$ potential is interesting but raises questions that should be discussed at greater leisure. There is evidence that the terminals, owing to their greater surface area, have a higher oxygen requirement and are more susceptible to asphyxia than are the motor neurons as indicated by antidromically induced soma and dendritic potentials. Since in Dr. Austin's work the $aN_1$ potential was reduced by asphyxia at the same time that the initial negative ($N_1$) potential was abolished, while a residual component of $aN_1$ remained, as did fiber potentials, I suggest that this $aN_1$ component is really a complex picked up from the afferent fiber and the terminals. As asphyxia occurs, the terminals are blocked, which result in failure of the interneuron stimulation and the absence of $N^1$. A residue of $aN_1$ remains because, like other fibers, the main intracord segments of the activated afferents are not readily blocked — they contribute the unimpaired component of the $aN_1$ potential.

## ZUSAMMENFASSUNG UND SCHLUSSFOLGERUNGEN

1. Es wird ein Überblick über die geschichtliche Entwicklung der Auffassung vom Rückenmarkschock gegeben.

2. Es wird angenommen, dass die Bedeutung der Theorie des Reflexverlustes mit allmählicher Rückwandlung in Hyperreflexie möglicherweise in ihrer Anwendbarkeit auf das Versagen der Synapsis und auf die Wiederaufnahme der Funktion durch höher gelegene Nervenzentren beruht.

3. Die hauptsächlichen physiologischen Beobachtungen nach hoher Durchschneidung des Halsmarks beim Menschen werden aufgezählt.

4. Die Ergebnisse neuer Untersuchungen des Rückenmarkschocks bei Katzen und Affen lassen die folgenden Schlussfolgerungen zu:

(a) Die Einschätzung der Bedeutung des monosynaptischen Reflexes beim enthirnten Tier hat sich zugunsten eines polysynaptischen Schwellenreflexes beim Rückenmarkstier verschoben.

(b) Nach Durchschneidung des Rückenmarks kommt es zu einer Desynchronisierung des negativen intermediären Potentials des Rückenmarks mit Neigung zur Fraktionierung dieses Potentials in eine frühe praesynaptische und eine spätere postsynaptische Komponente.

## RESUMEN

1. Se revisa el desarrollo histórico del concepto de choque espinal.

2. La posible significación de la teoría de la pérdida de los reflejos con vuelta gradual a la hiperreflexia se considera apropiada a la falla sináptica y vuelta funcional a niveles nerviosos superiores.

3. Se enumeran las observaciones fisiológicas cardinales después de la sección medular cervical alta [illegible] hombre.

1. Los resultados de investigaciones cientes en el choque espinal en el gato en el mono sugieren las conclusiones guientes:

a. Existe un cambio a enfatizar desde refeljo monosináptico en el animal cerebrado hasta el reflejo polisináptico nbral en el animal espinal.

b. Después de la sección espinal existe a desincronización del potencial negativo iermedio de la médula espinal con una ndencia a fraccionar su potencial en un mponente primario presináptico y uno rdío postsináptico.

## CONCLUSIONI RIASSUNTIVE

1. Viene passato in rassegna lo sviluppo orico del concetto di shock spinale.

2. Il possibile significato della teoria la perdita dei riflessi con graduale orno alla iper-reflessia viene considerato relazione alla perdita della sinapsi e al torno di una funzionalità a livelli neurali ù alti.

3. Vengono enumerate le principali osrvazioni dopo interventi sul midollo rvicale nell'uomo.

4. I risultati dei recenti studi sullo ock spinale nel gatto e nella scimmia ortano alle seguenti conclusioni:

a) esiste un mutamento di ampiezza a i riflessi monosinaptici nell'animale cerebrato e i riflessi polisinaptici nell'nimale spinale;

b) dopo resezione spinale si instaura una sincronizzazione del potenziale interediario negativo del midollo spinale con ndenza a frazionarsi in due componenti: e-sinaptica precoce e post-sinaptica tariva.

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# Relief of Spasticity in Paraplegia

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NEW YORK CITY, NEW YORK

ONE of the most distressing and incapacitating neurologic sequelae of injury to the spinal cord is intractable spasticity of the paralyzed extremities. In persons with traumatic paraplegia, spasticity of the paralyzed lower extremities becomes marked enough to impede rehabilitative measures in approximately 40 per cent of those with cervical and thoracic cord injuries. The relief of this spasticity will often enable a bedridden paraplegic to become ambulatory and self-sufficient. It is the purpose of this report to outline the neurosurgical methods that will alleviate intractable spasticity in the paraplegic patient.

*Physiologic Aspects of Spasticity.*—As the isolated spinal cord recovers from spinal shock, the first reflex to be elicited usually is a dorsiflexion withdrawal of the foot or great toe when the sole is stimulated. Gradually the segmental and more complex intersegmental reflexes return and enter a stage of heightened reflex activity.

*Flexor Response*: In the majority of cases, reflex activity of the isolated cord is predominantly flexor. Simple dorsiflexion of great toe and foot on stimulation of the sole will later spread to involve the hamstring and iliopsoas muscles, resulting in simultaneous flexion withdrawal of foot, knee and hip. Eventually, flexion of the stimulated extremity may be accompanied by extension or adduction, or both, of the opposite lower limb, owing to overflow of afferent impulses into intersegmental and commissural neuron pools. The deep tendon reflexes, as well as the cremasteric and bulbocavernosus reflexes, are attainable during this phase of reflex activity. In an occasional cas
stepping" may be elicited at t
that is, with the knee flexed, sudd
dorsiflexion of the foot causes
of the ipsilateral knee and ankl
panied by flexion of the contralat
and ankle. In some instances
ipsilateral extension occurs, in w
the reflex is referred to as "
thrust." The lower extremities a
in an attitude of moderate flexio
jects who manifest the flexor res

*Extensor Response*: In a min
cases the paralyzed limbs of "spin
become fixed in extensor, rath
flexor, rigidity. In such instances
and knees are extended, with the
toes plantar flexed. Stimulation of
results in exaggeration of exte
sponse. Although deep tendon refl
only slightly or not at all elicitabl
is demonstrable at knee and ankle.
is predominantly a defensive spin
whereas extension is a postural r
pendant upon the brain stem and
brain centers. It has been postula
in cases of incomplete transectio
cord in which there is extensor
reticulospinal and vestibulospin
ways mediate the extensor resp
is established, however, that
spasticity may occur in the prese
complete cord transection.

*The Mass Reflex*: In approxim
per cent of cases in which the fl
sponse is demonstrated during th
of heightened reflex activity the
become increasingly exaggerated,
ally responding to stimulation of
as a "mass reflex." At this time
tively minor stimulus results in a
outburst of moto [illegible]
ments of the i [illegible] r
is chara [illegible]

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Submitted for publication July 13, 1953.

es, knees and hips, with spasm of the minal musculature, particularly the , below the level of injury to the cord. ddition there is overflow of the nerv- energy into the lateral columns, re- ng in an autonomic outburst charac- ed by profuse sweating. There is also uation of the bowel and bladder. This ss reflex" is a powerful defensive al reaction and is characteristic of the vity of spinal reflex arcs isolated from asegmental inhibitory influences. In tion to this "release" mechanism, ff and Pool have presented evidence n "irritative mechanism" produced by ring of the distal stump of the cord, ch also contributes to the development he mass reflex in man.

s the mass reflex becomes increasingly nse, the area for reception of afferent uli capable of calling forth this reflex *masse* becomes more widespread and e readily receptive of exceedingly mi- stimuli. Eventually, stimulation of any it on the paralyzed limbs may produce mass reflex, and at times it is oc- oned by visceral stimulation.

he clinical sequelae of such hyperre- ic phenomena are well known. Con- it reflex movements of the lower ex- nities and the abdominal musculature tribute to formation of decubitus ul- , discourage adequate intake of food, n produce vomiting, prevent develop- nt of useful automatic bladder func- , and prevent rehabilitation. Fortu- ely, neurosurgical relief of the most in- ctable spasticity is not technically diffi- t or dangerous. One must accept the t that satisfactory relief of spasticity ends upon the sacrifice of certain nerv- elements which are producing involun- y muscular contraction. However, since se elements will never produce useful tor power, the only significance of the rifice is the realization it brings to the tient that these motor nerves are per- nently gone. The ultimate benefits of h a realistic approach will prove im- asurable.

*Technical Procedures.*—The procedures be described can be classified into four types: (1) peripheral neurectomy, (2) subarachnoid alcohol block, (3) rhizotomy and (4) subtotal spinal cordectomy.

The resection of peripheral nerves has rather limited usefulness in relief of spasticity in paraplegic persons. It is confined largely to resection of the obturator nerves for relief of adductor or scissors spasticity. When the incapacitating spasticity is largely confined to the adductor muscles of the thighs, the procedure of choice is bilateral transabdominal obturator neurectomy. This procedure can be performed easily and provides immediate relief. The nerve is approached retroperitoneally through a McBurney abdominal incision, and is readily identified as it emerges from the medial side of the psoas muscle to cross the brim of the pelvis. Stimulation of the nerve to produce adduction of the thighs positively identifies it prior to resection.

Subarachnoid alcohol block has emerged as the single most useful and most applicable method available for relief of paraplegic spasticity. The indications for subarachnoid alcohol injection are essentially those previously applied to anterior rhizotomy. The chief indication is intractable spasticity of the lower extremities, which have no useful motor or sensory function. Enough time should have elapsed from the time of injury so that the lesion may be known to be stationary; this eliminates the possibility of future neurologic recovery. This procedure has certain advantages over anterior rhizotomy. It is safer and more easily performed and is free of the hazards of major surgical procedure. Its effects are immediate and, in most instances, of long duration. It is, however, not selective. Thus, if certain nerve roots, such as those to the detrusor urinae, are to be excluded, this method is contraindicated in favor of selective anterior rhizotomy. Such contraindications, however, are rare, particularly since it has been demonstrated that satisfactory automatic micturition and sexual potency in the male can develop after subarachnoid alcohol injection.

The technic of subarachnoid injection

I now use is as follows: The patient is placed on his side in bed, and the foot of the bed is elevated 18 inches. An 18-gauge spinal puncture needle is inserted at the first lumbar interspace. A syringe containing 15 cc. of absolute alcohol is attached to the needle, and the alcohol is injected at the rate of 1 cc. every fifteen seconds. An assistant constantly checks the patient's vital signs and the level of anesthesia during the injection. The injection is continued until both legs have become completely flaccid or until 15 cc. of alcohol has been injected. The patient is then turned on his back and kept in this position for four to six hours. He is allowed out of bed on the following day. If the injection has not produced satisfactory flaccidity, it is repeated the following day, an additional 10 cc. of alcohol being used.

Relief of spasticity has been immediate and complete in 46 consecutive cases in which I have used this procedure. However, I have had 4 patients in whom spasticity returned within six to eighteen months. Satisfactory results were not obtained in these 4 patients by secondary alcohol injection, and surgical measures were resorted to. In 2 cases of quadriplegia, relief of spasticity in the lower extremities by alcohol injection was followed by onset of severe spasticity in the abdominal myotomes immediate superior to the level of the block. This subsided spontaneously within four weeks in each case. There have been no serious sequelae and no deaths in my personal experience with subarachnoid alcohol injection for paraplegic patients.

Rhizotomy, or intraspinal resection of nerve roots, is the time-honored method of relieving paraplegic spasticity since the introduction by Foerster of posterior root section for spastic paraplegia. The fact that posterior rhizotomy alone did not provide adequate relief of spasticity led Munro to develop the technic of anterior dorsolumbar rhizotomy. This method requires laminectomy and division of all anterior nerve roots from the tenth thoracic through the first or second sacral. The last firm dentate ligament is usually regarded as indicating the level of the first lumbar nerve root, although this relation is not invariable. If one is anxious to avoid sacrificing the motor supply of the detrusor urinae (usually second and third sacral), these roots can be positively identified by stimulating each sacral root individually and at the same time recording the intravesical pressure. Unless one is desirous of sparing certain nerve roots, such as those which innervate the urinary bladder, or unless some sensation exists in the lower extremities, subarachnoid alcohol injection is probably to be preferred to anterior rhizotomy. Kuhn has stated that subarachnoid alcohol block should be restricted to patients with total lack of detrusor innervation as determined by cystometric studies. However, it is now apparent that this criterion is too rigid, since satisfactory reflex emptying of the bladder is frequently achieved after subarachnoid alcohol block. Consequently, the indications for anterior rhizotomy have decreased markedly, and this operation is seldom used in my own paraplegic service.

Occasionally one is faced with the problem of recurrent spasticity following subarachnoid alcohol injection. In these circumstances the operation of anterior rhizotomy is made very difficult by the dense adhesive arachnoiditis produced by the prior alcohol injection. This arachnoiditis usually makes positive identication of individual roots impossible. In 4 such cases I have resorted to subtotal resection of the spinal cord. This subtotal cordectomy involves resection of the spinal cord and nerve roots below the level of the ninth or tenth thoracic segment. The operation requires a laminectomy extending from the ninth or tenth thoracic to the first lumbar level and is performed more quickly and easily than is anterior dorsolumbar rhizotomy. I have performed subtotal spinal cordectomy for intractable spasticity in 4 paraplegic patients.

McCarty has demonstrated that removal of the entire cord in man below the second thoracic level is not incompatible with life. In my limited experience, removal

### RESUMO

São revistos pelo autôr neste trabalho, a fisiologia, as manifestações clínicas e o tratamento neuro-cirurgico da espasticidade nos casos de paraplegia.

Estandartisa a indicação do tratamento neuro-cirúrgico em tais casos, citando como técnicas mais preconisadas a neurectomia periferica, a injeção subaracnoidea de alcool, rizotomia anterior seletiva, e a cordectomia espinhal subtotal.

Refere-se por fim aos resultados obtidos com tais metodos cirúrgicos.

### RESUMEN

Se revisa el fondo fisiológico, manifestaciones clínicas y tratamiento neuroquirúrgico de la espasticidad en la paraplejia. La espasticidad en paraplejia requiere tratamiento quirúrgico cuando hace imposible una rehabilitación adecuada, no responde al tratamiento conservador y complica músculos que no tienen una función voluntaria útil. Los principales métodos neuroquirúrgicos para el alivio de la espasticidad son, la neurectomía periférica, la inyección subaracnoidea de alcohol, la rizotomía anterior selectiva y la cordectomía medular subtotal. El método apropiado cuidadosamente seleccionado y aplicado, producirá invariablemente un alivio de espasticidad y mejoramiento del cuidado del paciente parapléjico.

### RIASSUNTO

E' stata trattata la fisiopatologia, la clinica e la cura neurochiurgica delle manifestazioni spastiche nella paraplegia. Tali lesioni richiedono l'intervento quando sono tali da rendere impossibile la rieducazione del paziente, quando resistono alla terapia conservativa e quando interessano muscoli a funzione volontaria non controllata. I metodi usati per vincere gli spasmi sono i seguenti: neurectomia periferica, iniezioni subaracnoidee di alcool, rizotomie anteriori elettive, cordotomie subtotali. Questi metodi, impiegati selettivamente, portano invariabilmente al miglioramento degli spasmi.

Common-sense nerve fibers are seldom medullated before forty—they are never seen even with a microscope before twenty.

Dermatographia is an outward and visible sign of an inward and hidden instability. We expect it in medical students about the month of May just before examinations.

—*Osler*

# Surgical Treatment of Congenital Spinal Disorders*

DONALD D. MATSON, M.D., F.A.C.S.
BOSTON, MASSACHUSETTS

BECAUSE the nervous system continues to grow and mature after birth, it is important to recognize any congenital disorders that may give rise to subsequent complications or progressive neurologic dysfunction as growth proceeds and to carry out corrective surgical procedures early in life whenever possible. Certain types of spina bifida occulta are accompanied by intraspinal lipomas, intraspinal meningoceles, fibrous stalks, dermoid cysts, bony spicules (diastematomyelia), or other lesions which, by compression or distortion of the growing elements of the neural axis, fall into this category. Early investigation and conservative surgical treatment are to be stressed.

Persistence of a congenital dermal sinus tract from the midline of the skin overlying the spine into the meninges or into the spinal cord itself may lead to infection within the central nervous system or the meninges. In addition, there may be expansion of the inner terminus of such a sinus into a cyst, which may act as a mass lesion in addition to being a focus for abscess formation. Prophylactic removal of all persistent dermal sinus tracts leading into the spinal canal is strongly recommended.

There is no routine treatment for meningoceles and myelomeningoceles associated with spina bifida; each constitutes a problem of its own, and the method and time for surgical treatment depend on many factors, such as the size and level of the lesion, the type of covering, the condition of the surrounding skin, the amount of neural involvement, the adequacy of the cerebrospinal fluid circulation (hydrocephalus), the economic and social status of the family, and so on. Rarely, meningoceles occur anteriorly as well as posteriorly, and this should be kept in mind in the consideration of undiagnosed masses in the mediastinum and in the retroperitoneal and retropelvic tissues.

Congenital tumors of the spinal axis warrant special attention, because there is a great temptation for the surgeon to be too radical in attempting to remove these benign lesions and thus make his patient worse. Dermoid and teratomatous lesions of the spinal canal should be approached conservatively, with emphasis on the contents of cysts, removal of the solid tumor and cyst wall which is freely mobilized, with no attempt at sharp dissection from neural tissue itself. This type of conservative management may be followed by an excellent return of neural function persisting for many years.

### Discussion by Dr. H. E. LeFever, Columbus, Ohio

DR. LEFEVER: I should like to limit my discussion of Dr. Matson's paper on stressing the relation between spina bifida occulta or aperta and intraspinal lipomas. My interest in this subject was quickened as I reviewed my series of 228 cases of intraspinal neoplasms and to my surprise found that 7 were lipomas. Three lipomas were found underlying spina bifida occulta; 3 accompanied spina bifida aperta, and only 1 was unrelated to a dysraphic defect. One of the 7 was of the rare intradural type, of w [illegible] c 30-odd have been [illegible] d [illegible] intr [illegible] lipomas coexisted. [illegible] cu [illegible] lipomas in the [illegible] ıe spinal mass. In 3 hirsutism was also present, overlying the defect.

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The clinical manifestations of intraspinal lipomas may differ from those of other intraspinal mass lesions in that root pains are uncommon despite the frequent involvement of the roots by the tumor and despite the fact that the intravertebral foramen is frequently filled with tumor tissue. Complete subarachnoid block is unusual, despite the large size of the tumor mass. The spinal roentgenogram may reveal evidence of congenital defects, and the spinal canal may be widened for a considerable distance in the region of the lipoma.

Histologically the tumors are composed of large, polygonal, closely approximated, translucent elements, seen in normal adult fat. In Dr. Elsberg's series of 254 intraspinal neoplasms, 4 were lipomas and 1 was related to spina bifida. In a series of 557 intraspinal tumors reported from the Mayo Clinic by Rasmussen, Kernahan and Adson, 4 lipomas were encountered. Three of these were related to congenital defects. It is the consensus that a congenital factor is present in the inception of most intraspinal lipomas, as is evidenced by the common association with spina bifida, cleft palate, harelip and multiple subcutaneous lipomas. Intraspinal lipomas constitute approximately 1 per cent of intraspinal neoplasms.

Should a roentgenographic survey of the spinal canal reveal spina bifida occulta in a patient showing evidence of an intraspinal compression syndrome, the possibility of a lipoma should be seriously considered.

### CLOSING REMARKS BY DR. MATSON

DR. MATSON: I like to think that the way to approach lesions associated with spina bifida occulta is radical investigation combined with very conservative surgical treatment. There certainly is little or nothing to be gained by manipulation of the cord itself or the cauda equina, whether the lesion is a dermoid cyst or one of the so-called lipomas (I like to avoid this term because I think we may get to think of them as discrete tumors, which they are not). These fatty masses may extend everywhere from the skin right on down into the substance of the cauda equina, and one may injure the neural tissue any time after the skin incision is made if he is not aware of the simple fact that the overlying fascia, muscle, bone and meninges may all be defective.

In so far as one can remove any structures that are compressing or distorting the cord or the cauda equina, divide fibrous bands, remove intraspinal meningoceles, excise discrete masses of fat, and remove dermoid cysts, surgical intervention is extremely worth while, but even then it must be carried out very carefully. Beyond that, I think it is meddlesome to feel that one must explore every patient simply because neurologic signs are present.

If Dr. Williams would like his problem of enuresis reduced to statistical terms, I certainly can't do it at this time. In a growing child there are all sorts of possibilities, but I think there isn't any question but that persistent enuresis, particularly if it has come on after a period of satisfactory bladder training and there are normal examinations of the urine and urinary tract, demands consideration of the possibility of a neurologic lesion. Enuresis alone, occurring without any evidence of other bladder disturbance or musculoskeletal disturbance, I should think is pretty rare as a result of spina bifida, congenital tumor or other lesion involving the cauda equina.

* * *

Thought is the labor of the intellect, reverie is its pleasure.

—*Hugo*

The soul is dyed with the color of its leisure thoughts.

—*Inge*

# Bladder Disturbances and the Management of Patients With Injury to the Spinal Cord*

ERNST BORS, M.D.

LONG BEACH, CALIFORNIA

IN summarizing my current policy as to the treatment of the traumatic cord bladder, I arrived at the following outline: Routine treatment should be instituted for upper and lower motor neuron lesions alike, preferably with tidal drainage. Permanent suprapubic cystostomy has been relegated to cases of cervical injuries that fail to respond to all efforts toward restoring bladder function or to cases in which there is incorrigible obstructive disease of the lower portion of the tract. Routine application of suprapubic cystostomy, still practiced by some, does not necessarily destroy the prospect of a balanced bladder function, but it postpones the achievement of this goal.

If routine treatment fails in a patient with a lower motor neuron lesion, transurethral resection is the procedure of choice.

If routine treatment fails in a patient with an upper motor neuron lesion, I employ the following procedures, in order of preference:

(1) Pudendal nerve anesthesia; if no permanent result occurs, (2) transurethral resection, with special consideration of the anterior lip; if this fails, (3) repetition of pudendal anesthesia with subsequent section of the pudendal nerve on the dominant side of the body (provided that the result from anesthesia was only temporary), and finally (4) section of the remaining pudendal nerve when all preceding interventions have failed.

DISCUSSION BY DR. THOMAS I. HOEN, NEW YORK

DR. HOEN: It is a privilege to appear on this program in connection with Dr. Bors' presentation. My colleagues and I have been interested in paraplegia since the beginning of the war, when we organized the paraplegic center at the U. S. Naval Hospital at St. Albans. Our interest has continued, but I realize, after hearing Dr. Bors present 844 cases in which he has personally treated these conditions, that we are comparative amateurs.

I find it difficult to discuss this paper, with all the data that have been presented, and shall limit myself to a few comments. Dr. Bors has used all the known methods of treating the neurogenic bladder, and, although he has not himself employed all of them, the ones he has used are the commonly accepted ones, and I think that it is valuable to know the results.

I am surprised to know that Dr. Bors does as many transurethral resections as he does. I know that during the war Thompson resorted to that procedure in an excessive number of cases, and considering it the answer to all problems of bladder management. My associates and I took rather an opposite stand, I think with justification. We studied our cases very carefully with cystourethrograms, and this enabled us to establish criteria and precise indications for resection of the vesical neck. Some of the patients with retention did not have the hypertrophied internal sphincter described by Thompson. Quite to the contrary, they had what we called a "funnel-neck bladder," with the internal sphincter wide open around the brim of the funnel. Obviously, resection of that internal sphincter could accomplish nothing toward relief of retention. We were of the opinion that in those cases the retention was due to spasticity of the external sphincter (the striated muscle), and for that reason we devoted our attention to relief of the spasm of this muscle by interruption of the lo[illegible] motor neuron supply, with varyi[illegible] r proce was to block the sacral nerve roots separately, with a view to relaxation of the sphincter. A clear-cut result, with ability to empty the bladder, was considered an indication for intradural anterior rhizotomy. In this case it was evident that muscle spasm was present without fibrosis. However, our results were not consistent and left us somewhat confused in our thinking.

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*Abstract of paper read at the Eighteenth Annual Congress of the United States and Canadian Sections, International College of Surgeons, New Nork, Sept. 13-17, 1953 [J. Internat. Coll. Surgeons 21:513-527 (April) 1954].

I could wish that Dr. Bors had classified his cases slightly differently from a neurologic point of view. I think it is a little unfortunate that he talked about cervical, upper thoracic, lower thoracic and lumbosacral lesions. This fails to recognize an area of importance and a definite type of injury which may be called the conus lesion. A lesion at twelfth dorsal level is apt to be a conus lesion. A lesion at the first lumbar is apt to be a conus lesion. To separate the twelfth dorsal from the first bar is apt to confuse the picture. I should refer to classify these cases as: (1) cervical esions, in which the entire sympathetic outflow is below the lesion; (2) lower thoracic lesion, in which a good bit of the sympathetic supply is above the lesion; (3) the conus lesion, in which there is destruction of the anterior horn cells involved in bladder function, and (4) the cauda equina lesion, a true peripheral nerve lesion as far as the motor supply is concerned (it is not a peripheral nerve as far as the sensory supply is concerned, because the injury is central to the sensory root ganglion). I think that if Dr. Bors' cases were classified in this way I should find it easier to follow some of the rationale of his treatment.

Unquestionably, it is most fortunate that a urologist of Dr. Bors' standing has devoted himself to this neurologic problem, and I trust that his association with neurologists and neurosurgeons has been as pleasant as it has been productive.

Dr. Harold C. Voris, Chicago: I should like to add my personal thanks to Dr. Bors for having come to us and for presenting, as a urologist, such an excellent paper on this problem, which certainly can be solved only by the continued cooperation of both urologists and neurosurgeons.

### CLOSING REMARKS BY DR. BORS

Dr. Bors: Dr. Hoen is quite right about the transurethral resection. I, too, am against its indiscriminate use. At the time when Thompson performed it in about 50 per cent of his cases, I did resections is only 5 per cent of mine. But as time goes on, changes take place that make resection necessary. I didn't mention that resection may become necessary at any time from seven months up to three hundred and sixty months after injury, and that is a long interval. After that interval resection becomes necessary not because of the striated muscles, which can be treated as I indicated in my presentation, but because of the smooth muscles, which become secondarily contracted, especially in those cases in which an upper motor neuron lesion of the conus has been converted into a lower motor neuron lesion. That still leaves the smooth muscles of the vesical neck entirely supplied by the sympathetic nerves, and consequently those muscles eventually become hypertrophied. Perhaps I did not make myself clear on that point.

As far as the conus is concerned, I fully concur with you. However, the term "upper or lower motor neuron lesions" refers to the conus. The additional differentiation of cervical, upper or lower thoracic and lumbosacral lesions still has its merits, because it describes the original level of the lesion; this in turn may be associated with an upper or a lower motor neuron lesion of the conus. At present I know of no clinical method, so far as bladder function is concerned, to distinguish a lesion of the conus from one of the cauda equina.

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It is better to give than to lend, and it costs about the same.

—*Sir Philip Gibbs*

When some men discharge an obligation you can hear the report for miles around.

—*Mark Twain*

# Evaluation of Skeletal Traction in the Treatment of Cervical Spine Injuries*

CHARLOTTESVILLE, VIRGINIA

WILLIAM GAYLE CRUTCHFIELD, M.D.

WHEN the spinal cord is severely injured at the level of the atlas or axis, it is probable that the patient dies immediately or at least before a clinical diagnosis can be made. Therefore, patients with compression fractures or dislocations high in the cervical spine show little, if any, evidence of spinal cord injury. Having the responsibility of a patient who has barely escaped a tragic end and whose injury is such that improper or inadequate treatment could result in sudden death, the attending surgeon is faced with a serious problem. I have no quarrel with those who believe that these patients should be treated by means of spinal fusion. In fact, my associate, aided by members of the department of orthopedic surgery, has operated on five of our patients. Good results were obtained, but on the other hand equally satisfactory results were obtained in a much larger series of cases treated conservatively. Moreover, throughout my experience with injuries of this type, which includes a period when treatment consisted only of applying a plaster support, no untoward effects from conservative treatment have been observed. Now that better methods of handling these patients are available, there seems to be less reason than ever for resorting to spinal fusion operations, which are by no means free of risk. The patient who has a satisfactory fusion operation may be able to discard his brace a little sooner than the one treated conservatively, but this is of minor importance when compared with the disadvantages of the major surgical procedure.

Compression fractures of the atlas and axis are more responsive to conservative treatment than are dislocations at these levels. They tend to remain in a satisfactory position and hence require a shorter period of traction, whereas dislocations are more apt to be accompanied by greater injury to the spinal ligaments that permits the vertebrae to slip out of alignment unless traction is maintained for a longer period. Injuries at this high level require very little traction, and the patients are comfortable except for their enforced bed rest. It has been our policy to continue traction for 8 to 12 weeks depending on the type and severity of the injury and then to rely on a light adjustable brace. Some patients are allowed to discard the brace after three months. Others are required to use it for six months or longer, depending on individual circumstances.

## SUMMARY

When properly applied, skeletal traction is the safest, most effective, and simplest method of treating patients with acute injuries of the cervical spine. Furthermore, when used to its full advantage it leaves few, if any, indications for laminectomy, spinal fusion, or plaster supports.

## DISCUSSSION BY DR. RALPH B. CLOWARD, HONOLULU

DR. CLOWARD: Many of Dr. Crutchfield's comments and suggestions are indeed welcome. In my particular locale, where we swim in the ocean the year round, injuries to the cervical portion of the spine are frequent. I probably encounter as many injuries of this type as do the majority of neurosurgeons, or more. I am perplexed at times to know just how to handle some of them. The first puzzle Dr. Crutchfield has answered for me is why these beautiful little tongs which he devised are continually slipping out of the skull. I fell heir to a half dozen pairs of his tongs right after the beginning of the war. Apparently they were the second edition, so to speak, of the Crutchfield tongs. Having too much respect for Dr. Crutchfield and his invention to complain, I never bothered to write him to ask why they kept coming out, so I proceeded to alter them so that they would not. I threw away the small drill which is used to make the hole in the skull. Through a 1 cm. scalp incision a trephine hole was made in the skull with a small Hudson drill, cutting through the outer table and the diploe down to the inner table. I copied the Blackshire tongs and had a blunt end made to replace the sharp end the Crutchfield tongs. The blunt end does not wander on into the skull or slip out after it is engaged in the larger hole.

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*Reprinted by permission of the Journal of the American Medical Association.

Another point I feel we should heed in Dr. Crutchfield's paper is the amount of weight used to reduce the dislocation. Certainly, leaving 15 to 20 pounds (6.8 to 9.1 Kg.) of weight on the patient for three, four or five weeks does interfere with proper healing. I was not smart enough, I must humbly admit, to realize why the fracture would not heal after the patient had been in traction for six weeks. It was distressing to find the dislocation drifting back to where it was in the beginning after traction had been removed.

One patient, a man 27 years old, had a rather severe fractured dislocation between the fifth and sixth cervical levels. No cord damage could be demonstrated, but severe pain and paresthesias were present in both upper extremities. The fracture was reduced and the alignment of the spine returned to normal with about 15 to 18 pounds (6.8 to 8.2 Kg.) of weight. Complete cessation of complaints and subjective symptoms was immediately obtained. The patient remained in traction for about six weeks. After the traction had been applied, there was marked increase in the width of the intervertebral space at the level of the fracture. As Dr. Crutchfield has pointed out, this probably is indicative of a tear of the anterior ligaments.

The traction was discontinued after six weeks. The Thomas collar was applied, and the patient was permitted to get out of bed. Within forty-eight hours after he first sat up, the pain, paresthesias and weakness in the upper extremities returned. A roentgenogram was obtained which demonstrated the body of the fifth cervical vertebra slipping forward on the sixth; the condition was as bad as it had been, six weeks before, when the patient was admitted to the hospital, or worse. There was a very wide space between the spinous processes of the adjacent vertebra at the level of the fracture.

The patient was returned to bed, the Crutchfield tongs reapplied and 15 pounds (6.8 Kg.) of traction used. The roentgenogram again showed the spine nicely aligned, and the same satisfactory clinical result was obtained—that is, complete disappearance of symptoms. The patient was kept in traction for another six weeks. This made a total of three months in bed. The next time he was permitted to get up the same thing happened. The pain and paresthesias in the arm and the weakness of the grip returned, there was recurrence of the dislocation, with obvious evidence that the fracture had failed to heal. The patient was then subjected to an open surgical operation. The dislocation was corrected by pulling the spinous processes of the fifth and sixth cervical vertebrae together and securing them firmly with a heavy stainless steel wire. Posterior spinal fusion was effected by placing bone over the adjacent laminae and spinous processes.

In all, this patient was hospitalized for approximately five and a half months before his fractured dislocation was healed. Because of my experience with this patient it became my practice to treat these lower cervical injuries—that is, the severe fractured dislocations of the bodies with little cord involvement but with definite evidence of root pressure—by early operation—wiring the spinous processes and fusing the laminae, with a greater chance of recovery and a shorter period of hospitalization. The patient is kept in skull traction while the spine is healing. In this way he is required to remain in bed only a month or six weeks.

The patient whom I have just described was operated upon in 1944. All conditions similar to his have been treated in this manner since that time. As a result of Dr. Crutchfield's remarks I may be able to save myself considerable work and my patients unnecessary surgical treatment by reducing the traction weight from 15 to 5 pounds (6.8 to 2.3 Kg.) after the first two days, if this will permit the torn ligaments to heal in a short time.

The practice of taking immediate roentgenograms to determine whether or not the fracture is reduced is a good one. If the interspace is too wide at the level of the fracture, the weight may be reduced. In Dr. Crutchfield's opinion, if a small amount of weight is kept on the patient for six weeks, the ligaments may heal and hold the fracture, thus making an open operation unnecessary.

Of course, there are always two schools of thought on every subject—whether one should operate on these patients early, wire the fragaments together, fuse the spine and *then* let them heal, or whether traction should be applied and the fracture be permitted to heal without operation. It would seem that the decision depends entirely on the individual case and the individual approach of the surgeon.

### DISCUSSION BY DR. THOMAS I. HOEN, NEW YORK

Dr. Hoen: It has been very interesting to hear first Dr. Crutchfield and then Dr. Cloward discuss skeletal traction. Before Crutchfield tongs were available, I applied traction by putting wires through burr holes in the skull. I think this method still preferable if the patient is to be kept in traction for six weeks or more as it is less irritating to the soft tissues and eliminates the possibility of slipping or brain injury. There is also a lower incidence of infection. However, I do use the tongs and know that they are the most valuable apparatus for quick application of skeletal traction.

With regard to management of the patient after application of traction, my policy has been to reduce the weight quickly after reduction has been accomplished, and to follow the patient with roentgenograms every six hours to see whether the position is held. If the position can be maintained with light traction for a time, I agree as Dr. Crutchfield, but if there is any tendency for the dislocation to recur with the reduced weight, I do then what Dr. Cloward does routinely—resort to open exposure and fixation of the spinous processes. Not all of these cases are the same. It depends a great deal on the fracture associated with the dislocation. If the facets or pedicles are fractured and do not give any support, the dislocation is apt to recur; but when the structures are minimally damaged good alignment after reduction is easy to maintain without the necessity of operation for internal fixation.

It might be interesting just to mention that we might all have begun using skeletal traction before we did, if it had not been for Dr. Cushing! In 1930, after a Harvard graduation celebration, one of the boys dove into the family swimming pool, in which there was no water. He arrived at the Peter Bent Brigham Hospital shortly afterward, accompanied by many relatives and friends and a number of prominent Boston physicians. Dr. Cushing was in a great dither, and all of us, including Dr. Horrax, were milling about trying to reduce a very bad fracture dislocation, without success. During a lull in the activities I said in a low voice to Dr. Cushing, "Why don't we get a pair of ice tongs like they hang the bodies up with in the morgue, fix them in his skull, and stretch him out a little bit?" He looked at me and said, "Hoen, what a horrible thought." Needless to say, several years elapsed before I thought of it again.

Many people enjoy nothing of their happiness, but the fear of losing it.
—*Rivarol*

Human felicity is produc'd not so much by great pieces of good fortune that seldom happen, as by little advantages that occur every day.
—*Franklin*

The secret of being miserable is to have leisure to bother about whether you are happy or not.

# Experimental Regeneration in the Spinal Cord*

W. W. CHAMBERS, Ph.D.

PHILADELPHIA, PENNSYLVANIA

EXPERIMENTS on central neuron regeneration, utilizing the bacterial polysaccharide Pyromen, have shown that this substance causes proliferation of undifferentiated connective tissue and phagocytes, and apparently by this mechanism prevents the formation of glial scar at the site of central injury.

The secondary effect of such glial inhibition is the regeneration, in limited quantity, of central neurons. The factors responsible for the recovery of these neurons after injury and their subsequent capacity for regrowth are not at present known, but do not appear to be due to the direct action of Pyromen. The capacity of central neurons for regeneration is strikingly poor, even when, under the influence of Pyromen, an apparently adequate substratum is present for the growth of their processes.

The main problem in regeneration of the central nervous system in adult mammals lies in the apparently limited capacity of the neuron itself to survive injury, and subsequently to show vigorous and active growth. An integral part of the problem is the intimate relation between neurons and glia. A most promising approach to the solution of this important problem is a careful study of the marked regenerative capacity in amphibia.

I returned from Atlantic City feeling new hope, even though the success of any application of the method to man might be remote indeed. Any hope for aid to the paraplegic patient must be kept alive.

It was with this feeling of responsibility that I decided to use Pyromen clinically. My only knowledge of the drug and of the therapeutic rationale had been acquired at this one meeting. I have now treated 16 patients, but only 7 will qualify for pertinent discussion.

1. P. O., the 15-year-old son of a physician, was injured in an automobile accident on July 31, 1950. He suffered a fracture-dislocation of the twelfth thoracic vertebra with physiologic transection of the spinal cord between the eleventh and twelfth dorsal segments. A laminectomy was performed on July 31 and again on August 18. The second exploration revealed necrosis of the cord at the level of the fracture-dislocation. Pyromen was begun on Aug. 13, 1952. It was evident that the drug could do little at this late date if its sole therapeutic action consisted of preventing the formation of glial tissue. This patient tolerated large doses of the drug over a period of many months, without any subjective or demonstrable benefit.

2. F. S., a man aged 64, had partial upper and lower motor neuron paralysis resulting from Paget's disease of the dorsolumbar portion of the spine and a ruptured third lumbar disc. A laminectomy was performed on Dec. 1, 1951, without resulting improvement. Pyromen was started on Oct. 2, 1952, and continued for four months, without demonstrable improvement.

3. W. M., a man 65 years of age, underwent operation on March 15, 1951, for rupture of the sixth cervical disc, associated with severe hypertrophic arthritis. There was evidence of injury to the spinal cord as well as severe radiculitis. He was given only three injections of Pyromen, because of severe reactions. For some reason, however, this patient subsequently had much less pain.

4. J. S., a youth 18 years old, suffered a fracture-dislocation of the second lumbar vertebra when a pile of plywood overturned on

him. Paralysis and anesthesia were present on the right, below the level of the injury. A laminectomy was performed immediately to decompress the cauda equina and the conus of the cord. Pyromen was begun immediately. A remarkable recovery has occurred. There is no proof that the drug was effective, as young patients sometimes improve phenomenally after injuries to the nervous system.

5. H. D., a man 34 years of age, had persistent "saddle-shaped anesthesia extending to the second sacral segment bilaterally. This condition followed spinal anesthesia for removal of a ruptured intervertebral disc at the fifth lumbar interspace. The patient was highly allergic, which at first made him reluctant to take any drugs. There had been practically no improvement until Sept. 8, 1952, when Pyromen was first employed. He has continued with this drug up to the present time, with phenomenal improvement. It is possible, of course, that the use of Pyromen was just coincident with spontaneous improvement, but this does not appear likely, either to me or to the patient.

6. B. K., a girl 14 years old, on June 6, 1952, suffered a compressed fracture of the first lumbar vertebra, with severe dislocation, when she was "jackknifed" by the falling tailgate of a truck. At first there was complete physiologic transection of the conus. A laminectomy was performed to decompress the cord. The use of Pyromen was begun on October 2. This patient has had a rather remarkable recovery. It is possible that the improvement would have developed anyway, considering the youth of the patient.

7. T. D., a 61-year-old man, was injured on June 8, 1948. He suffered a compressed fracture of the body of the fifth thoracic vertebra with complete physiologic severance of the cord at that level. A laminectomy was performed a few hours after the injury to decompress the cauda equina. Subsequently infectious hepatitis developed; also bed sores, which required plastic surgical treatment. On Dec. 15, 1950, a myelogram was taken because this patient had ceased to improve and because he was beginning to suffer with massive reflex motions of the lower extremities. The myelogram revealed partial block at the site of the old injury. On Dec. 11, 1951, the cord was explored at the site of the partial block. It was somewhat smaller than normal and was adherent to the meninges on the right. The patient made some improvement after this operation, but the spastic paraplegia became worse and the reflex mass movements of the lower extremities increased. Pyromen was begun on Aug. 13, 1952, and has been continued ever since. There has been great improvement. The spastic paraplegia has largely disappeared, and the reflex massive movements are no longer troublesome. He has regained sensation to touch over the lower part of the trunk, the entire right leg, and the left leg down to the knee. It is exceedingly difficult to explain the improvement in this patient, which has occurred four years after the injury, if the only function of the drug is the prevention of the formation of glial tissue. I am fairly well convinced that Pyromen did cause the improvement. It would appear, therefore, that this drug must have some other action of value.

Many of our cares are but a morbid way of looking at our privileges.
—*Scott*

To carry care to bed is to sleep with a pack on your back.
—*Haliburton*

Worry is interest paid on trouble before it falls due.
—*Inge*

I have never yet met a healthy person who worried very much about his health, or a really good person who worried much about his own soul.
—*Haldane*

# Tumors of the Brain and Spinal Cord as They Concern the General Surgeon

HENDRIK J. SVIEN, M.D., F.A.C.S.*
AND ANDREW L. KARAVITIS, M.D.**
ROCHESTER, MINNESOTA

IN this day of specialization in medicine, the trend is for each specialist to concentrate increasingly on the particular field he has chosen. This trend, of course, has been beneficial in many ways. Nonetheless, it is prudent now and then to survey one's course in any specialty, and to reflect that diseases and pathologic processes still take no heed of specialization. That is, they still manifest themselves in symptoms that are quite nonspecific.

Let us consider some examples. To the general surgeon, the symptoms of nausea and vomiting suggest appendicitis, disease of the gallbladder or obstruction of the bowel. To the neurosurgeon, however, the same symptoms suggest increased intracranial pressure. Pain in the right upper abdominal quadrant causes the general surgeon to think of a diseased gallbladder, but the same pain makes the neurosurgeon speculate on the presence of a tumor of the spinal cord. One could go on similarly with other symptoms — headache, pain in the precordial region and the like.

Fortunately, in most instances of appendicitis or disease of the gallbladder, other symptoms and signs besides the nausea and vomiting are present to make the true diagnosis quite certain. Yet there are cases in which the situation is called "borderline" — meaning that the associated signs and symptoms are not fully convincing and the diagnosis is not clear. It is in this borderline type of situation that physicians in different specialties must work together for solution of the problem in the best interests of the patient. A few cases which present so-called borderline situations will show what is meant and the problems involved.

Man is not perfect; if he were, physicians and surgeons would have nothing to do. Still less do we expect surgeons to be perfect in their mastery of every possible surgical situation that may arise. It is known and recognized, in fact, that no one man today is able to master every conceivable ramification of surgery; were it otherwise, there would be no surgical specialties. The general surgeon performs with ease a procedure that might be strange to the neurosurgeon; conversely, the neurosurgeon has amassed certain skills an a body of special knowledge that migh never be demanded of the general surgeon

For these reasons, the illustrative case to be presented here reflect discredit o no one. Quite to the contrary, they onl point up again what has been known fo many years: that when a particularly stub born diagnostic problem challenges the i dividual practitioner in any field, the vi tues of consultation can be very grea

## REPORT OF CASES

CASE 1.—Recently we saw in consultatio patient who had undergone cholecystecto four weeks before. He was a recent im grant, a fact which only complicated the di culties of diagnosis by interposing a langu barrier. This man had some epigastric tress after heavy meals for several years, had not had pain in the right upper abdomi quadrant or episodes of jaundice. Three we before the *cholecystectomy nausea, vomiting* and some headache had developed. The nausea and vomiting occurred daily. Cholecystograms had been taken, and they revealed gallstones. Cholecystectomy was carried out. Yet nausea *and vomiting persisted, as did the headache.*

Headache can be indicative of much or of nothing; many persons have headaches; many, for instance, who have indigestion complain of headaches. However, the headache of this man was *typical of the headache of brain tumor.* It was present in the frontal and temporal areas and was worse on the right side. It came on daily, in the early morning, and frequently awakened the patient at 4 a.m.

The patient also said that he had periods of double vision at this time. Double vision also is a symptom of brain tumor, which produces increased intracranial pressure. This particular defect in vision is due to pressure on the sixth intracranial nerve, which innervates the lateral rectus muscle of the eyeball. This nerve has a long intracranial course and is often the first to be affected by increased intracranial pressure.

Neurologic examination disclosed minimal left hemiparesis. Funduscopic examination revealed chronically choked ocular discs of 3 diopters. It is highly probable that some degree of edema of the optic discs had been present at the time of cholecystectomy. Roentgenograms of the skull revealed a shift of the calcified pineal gland to the left, indicating *displacement by a mass on the right* (Fig. 1). Electroencephalographic study revealed a delta focus in the right frontal region. A right carotid arteriogram was taken; it demonstrated displacement of the anterior cerebral artery to the left (Fig. 2). At operation a *large meningioma, a benign tumor,* was completely removed (Fig. 3). Because of the location of the lesion in the right frontal area, accessible for removal, the patient recovered without further neural defect. The results of *neurologic examination when the patient was* dismissed were essentially negative.

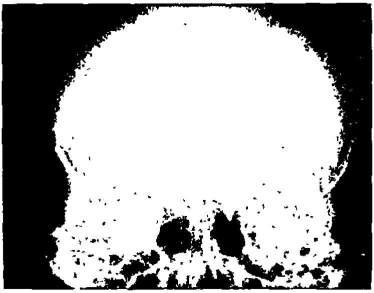

Fig. 1.—Displacement of a calcified pineal gland to the left.

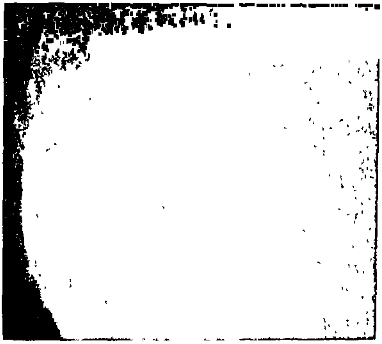

Fig. 2 [illegible]
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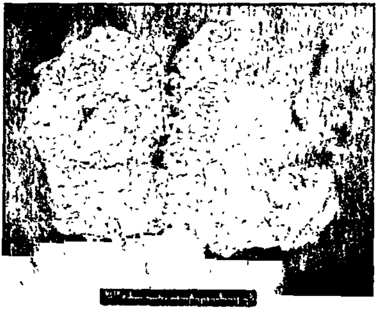

Fig. 3.—Meningioma removed in Case 1.

CASE 2.—The patient was a child, aged 2½ years, who had undergone appendectomy three weeks prior to admission because of nausea and vomiting, followed by stomachache. These symptoms had been [illegible] weeks before the op[illegible] been relieved by [illegible]

tained, and attention would have been directed to the area concerned. It is highly probable that separation of the suture line and the choked optic discs were present then.

At operation a cystic astrocytoma with a mural nodule in the midline of the cerebellum was completely removed. The prognosis associated with such a lesion is hopeful, since this type of tumor is benign. However, the condition of the patient was rapidly deteriorating, and had operation been delayed for a few more days, it is doubtful that he would have survived it.

CASE 3.—A man aged 62 stated that he had lost 25 pounds (11.3 Kg.) and that anorexia had developed during the three or four months prior to his admission. Gastrointestinal roentgenograms revealed slight widening of the duodenal loop and suggested a retroperitoneal mass. Yet a mass was not detectable by palpation of the abdomen.

Abdominal surgical exploration was advised, but because the patient had complained of daily mild headaches, neurosurgical consultation was requested. The results of neurologic examination and of examination of the ocular fundi, as well as of roentgenograms of the skull, were negative, but the electroencephalogram showed left frontal dysrhythmia (Fig. 5). We decided that, although the abnormal signs were not too impressive, the presence of a brain tumor should be excluded before an abdominal operation was carried out. Ventriculograms were taken; they revealed a marked shift of the ventricular system to the right and other signs indicating the presence of a brain tumor in the left frontal area (Fig. 6). These observations—the widening of the duodenal loop and the evidence of an intracranial mass— could be well explained by a metastatic process from a retroperitoneal carcinoma. Craniotomy, however, was done, and a large meningioma in the right frontal region was removed. The tumor was benign.

The patient's outlook for life is excellent. Interestingly enough, at subsequent roentgenologic examination the previously suspicious widening of the duodenal loop could not be confirmed. In the six months after the operation there was no sign or symptom of abdominal tumor.

CASE 4.—A woman aged 45 had pain in the right upper abdominal quadrant, associated with periods of epigastric distress and occasional nausea and vomiting. Cholecystograms revealed cholelithiasis. Cholecystectomy was carried out, but the pain in the right upper abdominal quadrant persisted and became progressively more troublesome.

This patient was seen three months after cholecystectomy. At this time she had clear-cut signs of a tumor of the spinal cord—weakness of both lower extremities, loss of sensation in the legs, some degree of spasticity in the legs, Babinski's sign, and incontinence of bowel and bladder.

Study of the patient's history shows that it would have been quite clear to a neurologist or a neurosurgeon that she had signs and symptoms highly suggestive of tumor of the spinal cord at the time of cholecystectomy. The pain in the right upper abdominal quadrant was typical of the pain caused by irritation of a nerve root. It had begun a year or more before the operation and had been fairly persistent. It extended from the spinal column, at the level of the eighth thoracic vertebra, along the costal margin and into the right upper quadrant. This pain was markedly accentuated when the patient coughed or sneezed.

Another characteristic of the pain is almost pathognomonic of tumor of the spinal cord: The pain invariably awakened the patient from four to six hours after she had retired, and she often had to walk the floor for relief or finish the night's sleep by sitting up in a chair. One possible explanation for this rather typical manifestation of the pain of a tumor of the spinal cord is that the tumor displaces and stretches the sensory roots overlying it. Then, as the patient lies down, the intervertebral discs, no longer compressed by the patient's weight, balloon out, thus elongating the spinal axis. This elongation causes the sensory roots to be stretched even more, and pain results. When the patient gets up, the intervertebral discs support weight and collapse to some extent, with the result that the stretch on the sensory root is lessened and pain consequently is relieved.

Myelographic investigation with ethyl iodophenylundecylate (Pantopaque) was carried out, and a defect in the opaque column was noted at the level of the eighth thoracic vertebra (Fig. 7). At operation a meningioma, a benign tumor, was completely removed (Fig. 8). Figure 8 diagrammatically illustrates the operative observations. It indicates how the eighth thoracic sensory root was stretched by the underlying tumor.

This patient has made definite improvement in the use of her legs since the tumor was removed. However, at the time of this writing she was unable to walk. We hope that in another year or so she will have regained most of her muscle power. It is our opinion, however, that had the tumor of the spinal cord been recognized and removed at the time the gallbladder was taken out she would not have been incapacitated subsequently.

*Comment on Case 4.* — Roentgenologic examination of the spinal column of a patient suspected of having a tumor of the spinal cord may show changes of diagnostic importance early in the course of the tumor, before many definite clinical signs are present. Calcification within the spinal canal, such as accompanies about 10 per cent of meningiomas, may be seen. In some cases, widening of the intraspinal canal and pedicular erosion are evident. In the presence of "dumb-bell" tumors, which grow from the nerve root inside the dura out through the intervertebral foramen, the latter aperture is abnormally enlarged.

As has been said, the foregoing changes sometimes are demonstrable roentgenologically before the clinical signs and symptoms are far advanced. When these demonstrable changes are added to other suggestive observations, the diagnosis of tumor of the spinal cord can be substantiated.

CASE 5.—The patient was a man 60 years old. He had been in good health until April 1953. At that time he had first noticed pain in the lumbar area of the back, with extension into both flanks. In August he had become progressively constipated, and it was thought that the caliber of his stools was smaller. He required more and more laxatives to produce a bowel movement. A gastrointestinal roentgenographic series was done; during this period the abdomen became distended. The results of the gastrointestinal roentgenograms were not available, and so it is not clear whether or not a lesion was disclosed. Surgical abdominal exploration was carried out, but no demonstrable cause for the abdominal distention was found. The patient was treated with suction for paralytic ileus, and the distention was relieved in this way.

At the time we saw him, in October 1953, he was unable to walk because of ataxia and marked weakness of the legs and ataxia. He was incontinent of bowel and bladder. Exami-

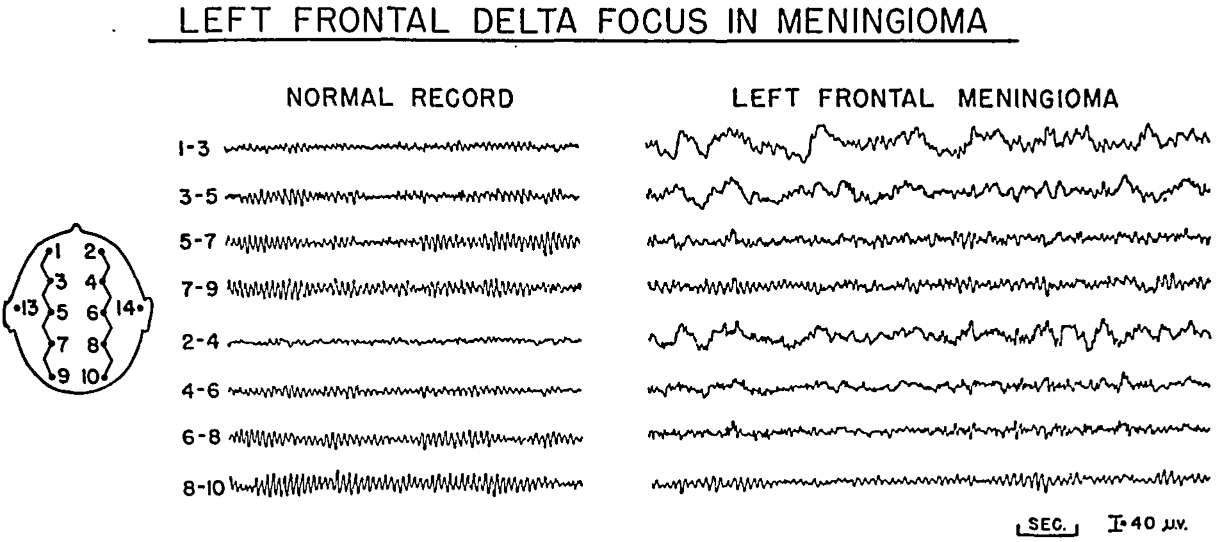

Fig. 5.—Electroencephalogram in Case 3, showing left frontal dysrhythmia.

nation revealed paresis of both lower extremities extending up to the eighth thoracic level and a sensory loss extending up to the same level. It was evident that this man had compression of the spinal cord. Roentgenologic examination of the spinal column revealed a destructive process involving the ninth and tenth thoracic vertebrae and a paravertebral soft tissue mass in this region.

At operation, compression of the spinal cord by caseous material, which proved to be of tuberculous origin, was observed. The caseous material was removed, so as to decompress the spinal cord. It is possible that this patient will regain the use of his legs, but it may be a year or more before he has the strength to walk.

*Comment on Case 5.* — Again, in this case, we are sure that the diagnosis of a lesion of the spinal cord could have been made before paralysis developed and an unnecessary abdominal operation carried out. The pain in the back was typical; it was aggravated by cough and sneeze and straining, and it awakened the patient at night. Constipation may accompany a lesion of the spinal cord—the patient avoids a bowel movement because the straining involved is painful. Then, as compression of the spinal cord increases, pathways concerned with innervation of the bowel and bladder become involved. At times, abdominal distention is associated with lesions of the spinal cord. This is true particularly when the damage to the cord is acute, as in cases of injury.

Had a roentgenogram of the spinal column been made in August, at the time of the abdominal operation, the destructive lesion would doubtless have been apparent.

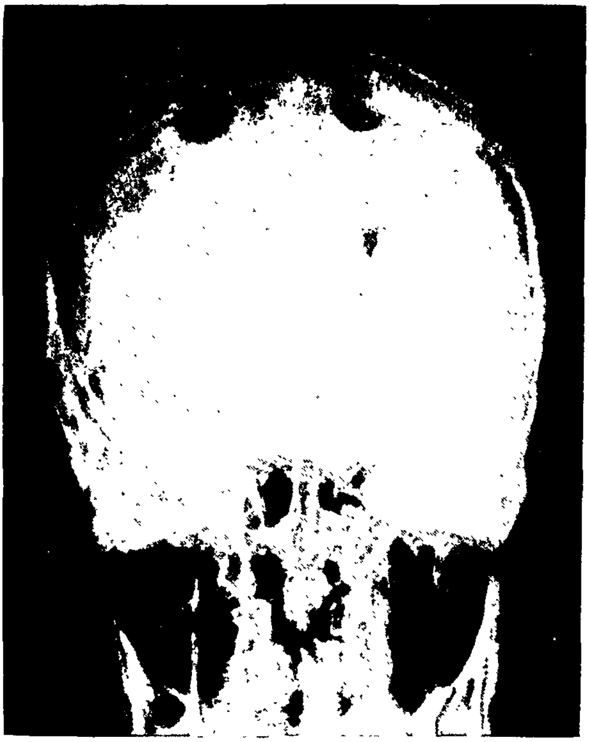

Fig. 6.—Ventriculogram, same case, indicating shift of the anterior portion of the lateral ventricles and the third ventricle to the right.

If the compression of the spinal cord had been relieved at that time, the patient would not have become paralyzed.

CASE 6.—A man aged 56 had undergone gastric resection for a Grade 2 small cell carcinoma two years prior to the time we saw him. He was examined because of pain in the right hip. The pain was severe and incapacitating, and it troubled him even at rest. Roentgenologic examination of the stomach and the site of anastomosis suggested local recurrence of the malignant process. The results of gastroscopic examination, however, were negative. Roentgenologic examination of the lumbosacral area of the spinal column gave negative results, but roentgenograms of the right hip showed some sclerotic changes, which could be interpreted as metastatic involvement. It was felt that the pain was most probably due to metastasis. Because of the severity of the pain, the patient insisted that something be done. Neurosurgical consultation was requested, with chordotomy in mind.

When the patient was questioned, it was learned that he had some degree of backache and pain radiating into the sciatic distribution, down to the ankle. The results of sciatic nerve-stretching tests were positive; the pain was accentuated by bending, coughing and sneezing. The attack had come on insidiously two months before, without any known trauma. However, it was learned that the patient had had similar, less severe and less prolonged attacks five years earlier.

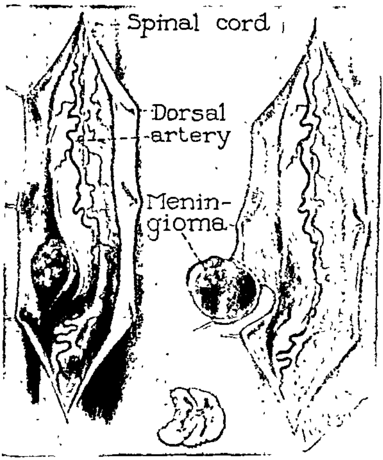

Fig. 8.—Sketch of operative observations in a case similar to Case 4 [reproduced, with permission of the publishers, from: Camp, J. D.: Contrast Myelography, M. Clin. North America 25: 1067-1102 (July) 1941].

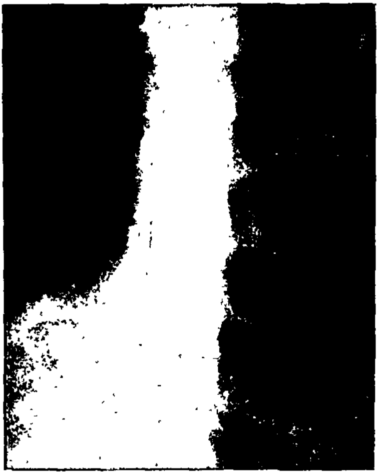

Fig. 7.—Pantopaque myelogram in Case 4, showing defect in the opaque column on the right side at the level of the eighth thoracic vertebra. The defect is characteristic of an intradural, extramedullary tumor.

It was concluded that the pain might well be due to a protruded intervertebral disc. Pantopaque myelographic study revealed a defect at the fourth lumbar interspace (Fig. 9). At operation a ruptured intervertebral disc was removed. Subsequently the patient was completely relieved of his pain.

## COMMENT

Each of the foregoing 6 cases has these 2 points in common: (1) as far as the general surgical diagnosis is concerned, the condition present was what has been called "borderline," the signs and symptoms being atypical in some respects; (2) each of the patients had presented, at the time of the general surgical operation,

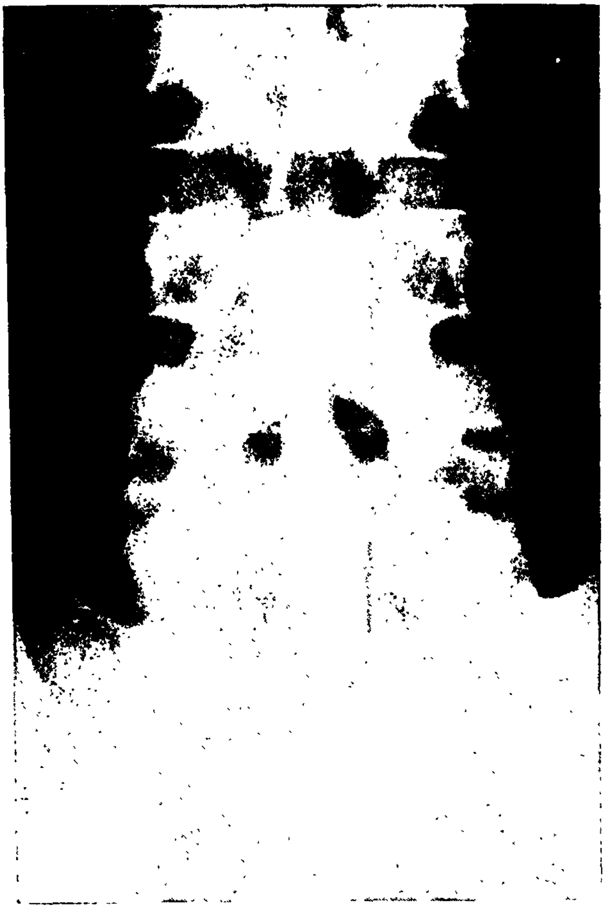

Fig. 9.—Pantopaque myelogram, indicating a defect at the fourth lumbar interspace on the right side in Case 6. The defect is typical of that produced by a protruded intervertebral disc.

signs and symptoms which, if not conclusive, were certainly suggestive of involvement of the central nervous system.

The lesson contained in these cases is clear: When the general surgeon sees a patient in whom a cardinal symptom or sign is lacking or atypically manifested, he must reevaluate the condition at hand from the standpoint of neurologic disorder, particularly if other signs or symptoms, not usually typical of the condition thought to be present, are detected. The neurologic or neurosurgical colleague of the general surgeon has many tools—myelography, carotid arteriography, electroencephalography roentgen rays, air studies and the like—which can be employed readily, together with the neurologic examination, without undue risk or delay.

Conversely, the neurologic surgeon has much to learn from the general surgeon. When the liaison between the two is good, the accumulated skills and knowledge of both cannot but redound to the welfare of the patient and enhance diagnostic acumen in the fields of both general surgery and neurosurgery.

## SUMMARY

The authors report 6 cases of "borderline" neurologic lesions easily confused, by reason of their equivocal signs and symptoms, with lesions unrelated to the nervous system. They emphasize the fact that a better liaison between the general surgeon and the neurologist is needed, in the best interests of the patient, to prevent errors in diagnosis and delay in treatment. It is recommended that the general surgeon, when confronted with signs and symptoms indicative but not pathognomonic of a condition in his own field, consult the neurologist and avail himself of the many advantages provided by neurologic diagnostic aids — myelographic, carotid, arteriographic and electroencephalographic examination, air studies, etc. The authors point out that the neurosurgeon has much to learn also from the general surgeon, and that a closer relation between them would give the patient the benefit of their combined knowledge and experience.

## RÉSUMÉ

Les auteurs rapportent six cas d'affections neurolgiques qui paraissent n'avoir aucun rapport avec le système nerveux, eu égard à des signes et symptômes équivoques, qui font penser à d'autres affections. Ils insistent, pour éviter des erreurs de diagnostic et de retard dans le traitement, sur une meilleure collaboration entre le chirurgien de culture générale et le neurologue. Il est recommandé au chirurgien de culture générale, lorsque le malade ne présente pas une symptomatologie pathognomonique, de consulter un neurologue et de faire une myélographie, une artériographie carotidienne, une électro-encéphalographie, une ventriculographie etc.

Les auteurs signalent que le neurochirurgien doit également tenir compte de l'expérience du chirurgien de culture générale. Cette collaboration entre les deux spécialistes ne pourra qu'être utile au malade.

### RIASSUNTO

Gli autori riportano 6 casi neurologici che non vennero riconosciuti perchè le loro manifestazioni cliniche non furono chiare e le lesioni non erano in relazione col sistema nervoso. Ciò li porta ad insistere sul fatto che, nell'interesse dei pazienti, è necessaria una più stretta collaborazione fra chirurgo e neurologo ai fini di una diagnosi corretta e di una pronta terapia. Il chirurgo, cioè, ogni volta che si trova dinnanzi a sintomi non del tutto caratteristici di una malattia chirurgica, deve consultare il neurologo, in modo da potersi avvalere dei molti vantaggi offerti dai mezzi diagnostici neurologici, quali la mielografia, l'arteriografia, l'elettroencefalografia, la ventricolografia, ecc. L'autore sottolinea il fatto che il neurochirurgo ha molto da imparare anche dal chirurgo generale, sicchè una puú stretta collaborazione fra loro può offrire ai pazienti il beneficio della loro congiunta esperienza.

### ZUSAMMENFASSUNG

Die Verfasser berichten über sechs neurologische Grenzfälle, die auf Grund ihrer zweideutigen klinischen Zeichen und Symptome leicht mit Erkrankungen verwechsel werden können, die in keiner Beziehung zum Nervensystem stehen. Es wird betont, dass zur Verhütung diagnostischer Irrtümer und zur Vermeidung einer Verzögerung in der Behandlung eine enge Zusammenarbeit von Chirurg und Neurologen notwendig ist, und dass auf diese Weise den Interessen des Kranken am besten gedient wird. Der Allgemeinchirurg wird angeregt, in Fällen, wo das klinische Bild zwar auf eine in sein Gebiet fallende Erkrankung hinweist, aber nicht pathognomonisch ist, einen Neurologen zu Rate zu ziehen, und sich der reichen Vorteile der neurologischen Diagnostik (Karotisuntersuchung, mysolographische,. arteriographische, elektroenzephalographische und pneumoenzephalographische Verfahren) zu Nutze zu machen. Umgekehrt, kann auch der Nervenchirurg viel vom Allgemeinchirurgen lernen, und eine enge Zusammenarbeit beider gibt dem Kranken die Möglichkeit, von ihrer gemeinsamen Erfahrung und Kenntnis zu profitieren.

### RESUMEN

Los autores comunican 6 casos de lesiones neurológicas incipientes que a causa de síntomas y signos equívocos son facilmente confundibles con lesiones no relacionadas al sistema nervioso central. Se hace notar el hecho de la necesidad de cooperación entre el cirujano general y el neurólogo para beneficio del paciente, para prevenir errores diagnósticos y retraso en el tratamiento. Se recomienda que el cirujano general ante signos y síntomas no patognómonicos indicadores de padecimiento comprendido en su campo de acción, debè consultar al neurólogo proveerse de los muchas ventajas que aportan los coadyuvantes diagnósticos de la neurología, exámenes mielográficos, arteriográficos carotídeos, electroencefalográficos, insuflaciones, etc. Los autores señalan que el neurocirujano tiene mucho que aprender también del cirujano general y que mientras más estrecha sea esta relación el beneficio será mayor para el paciente debido a la esperiencia y conocimiento combinados.

# Transabdominal Anterior Discographic Examination

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THE diagnostic value of discographic examination, the technic of which was first described by Lindblom,[1] was supported by the studies of Erlacher,[2] Witt,[3] Gardner and his associates,[4] Wise and his co-workers,[5] Cloward and Buzaid[6] and others.[7] It is the only procedure that permits roentgen visualization of the size and configuration of the nucleus pulposus. It is also the only one that permits recognition of the various stages of degeneration of the nucleus, as well as the terminal changes represented by tear or rupture of the annulus, with prolapse or herniation of the pulpous material.

Although it is established that discographic study yields a far greater percentage of correct diagnoses than do other, more conventional diagnostic procedures either singly or in combination, its more frequent employment is hampered partly by the technical difficulty of the procedure and partly by the clinical sequelae inherent in the transdural and epidural injection of radiopaque solution into the disc.

The standard posterior discographic or nucleographic investigation is performed as follows: A spinal needle of 18 to 20 caliber is introduced between the spinous processes at the desired lumbar level and advanced, either transdurally or epidurally toward and to the intervertebral disc to be examined. After the proper position of this needle has been ascertained by roentgenograms, a second needle, of much smaller caliber (22-26 gauge), is inserted through the lumen of the previously placed needle until the tip of the second needle reaches the approximate center of the disc. Additional roentgenograms are taken to verify the position of the second needle within the disc substance. A water-soluble opaque material is then injected through the second needle, and anteroposterior and lateral films are taken. Usually two and occasionally three discs are examined in this manner. It is obvious that the procedure must be time-consuming even in experienced hands.

The purpose of this communication is to present the technic of transabdominal anterior discographic examination. With an open abdomen this is a simple procedure. It can be speedily and safely performed upon patients with chronic backache (a very large group) who, for various other reasons, are undergoing operations on the pelvis or the lower part of the abdomen.

During investigative work in connection with transabdominal supplemental spinal analgesis,[8] I made a series of anterior disc injections to determine whether any leakage of the pulpous nucleus occurs along the puncture tracts of the spinal needles employed with their various calibers. The ease with which these injections were accomplished prompted the idea that anterior or transabdominal discographic methods could be used to advantage during laparotomies. Subsequently a total of 37 anterior disc injections were performed on 15 unselected patients. Injections were made into the disc L 3=4 in 6 cases, into the disc L 4=5 in 14 cases and into the lumbosacral disc in 12 cases. During a pneumonectomy injection of contrast medium into 5 intervertebral discs was done for clinical study. These are also in-

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cluded in the series under discussion.

The opaque solution used was Diodrast in concentrations of 35 to 70 per cent. History of backache and other pertinent information is presented in the accompanying table.

*Indications.*—In patients whose histories include complaints of chronic recurrent backache and who are undergoing operations in the pelvis or the lower part of the abdomen, transabdominal discographic investigation can be performed with advantage as a diagnostic procedure.

*Contraindications.*—The procedure should not be employed in the presence of (a) infection of the peritioneal cavity or its contents, (b) malignant disease with metastases along the large vessels or (c) marked obesity.

*Procedure.*—The equipment used for disc injections consists of two Sana-lok syringes of 3 cc. capacity, each loaded with Diodrast and armed with a standard curved tonsil needle. The long-shafted tonsil needle has a 23-gauge tip ½ inch (1.2 cm.) long, which, when fully inserted through the annulus, penetrates into the substance of the pulpous nucleus, thus depositing the opaque solution at the same depth in every disc into which an injection is made.

The Sana-lok syringe has a twofold advantage: first, it has rings for the fingers —this assures a firm, nonslip grasp, which is important when appreciable pressure has to be employed while the resilient nucleus of the disc is injected. Second, it has a short, smooth metal plunger, which slides within the barrel of the syringe with far less friction than the full length cylindric ground-glass plunger. Both of these features are of advantage

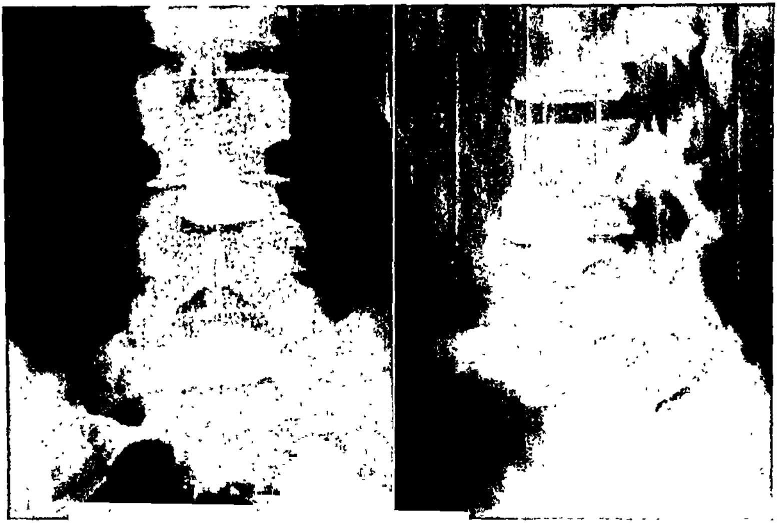

Fig. 1.—Discogram of a patient with history of low backache for the last three months preceding the operation. Note the normal square nucleus in the lumbosacral disc and the oval nucleus with a single posterior branch at disc L 4-5.

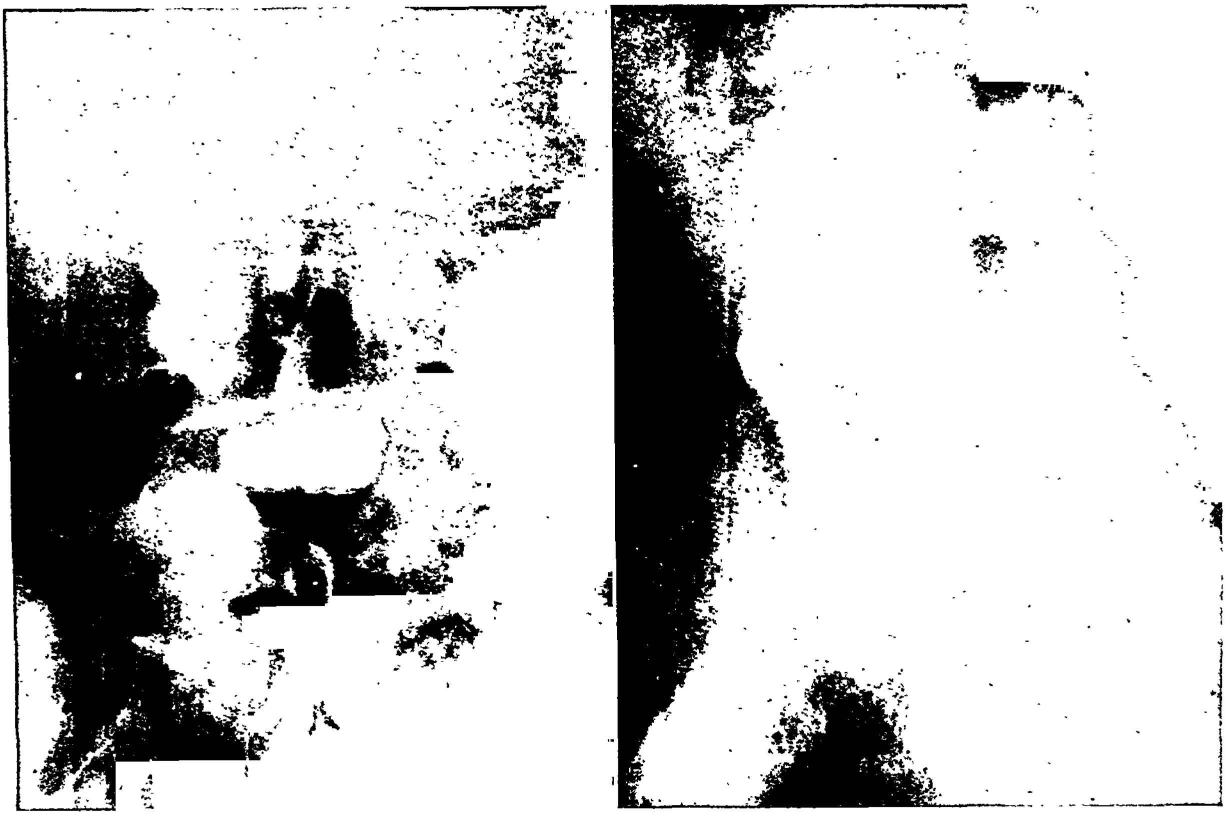

Fig. 2.—Discogram of a patient with a history of low backache without sciatic radiation for five months before operation. Note the flattened multilobulated nucleus with anterolateral and posterior herniation at Disc L 3-4. The disc at L 4-5 shows a normal square nucleus.

when the near-saturate solution of opaque medium is injected through a small-caliber needle into a substance that possesses considerable intrinsic tension.

If anterior discographic study during laparotomy is contemplated, a midline incision should be preferred. This approach, with the muscular relaxation and quiet abdomen associated with spinal analgesia, is ideal for good exposure of the pelvic organs and the distal lumbar segments. In patients of average or normal physical proportions, incision between the navel and the symphysis readily allows injection of the fluid into the discs at L 4=5 and L 5=S 1. If the patient is short and squatty, or if it is desired to reach the disc at L 3=4 or a higher segment, the incision must be extended along the left side of the umbilicus or even ½ inch (1.2 cm.) above it.

After routine exploration, the patient is placed in the Trendelenburg position to allow the intestines to slide into the upper part of the abdomen where they are confined with packs and retractors.

Unless the patient is markedly obese, there is no difficulty in visualizing the aorta, or in defining its contour by palpation. In like manner, the slightly elevated annulus of the disc, which gives a sensation of elastic rebound to the palpating finger, can be readily differentiated from the much wider, somewhat concave, nonelastic rigid vertebral body.

As the disc is located, the nail of the palpating finger is firmly anchored to the convexity of the elastic annulus and held in position there until the needle is inserted and the injection completed.

The needle should never be advanced forcibly. The disc margin (the annulus fibrosus) will always permit easy introduction of the needle unless it is shielded

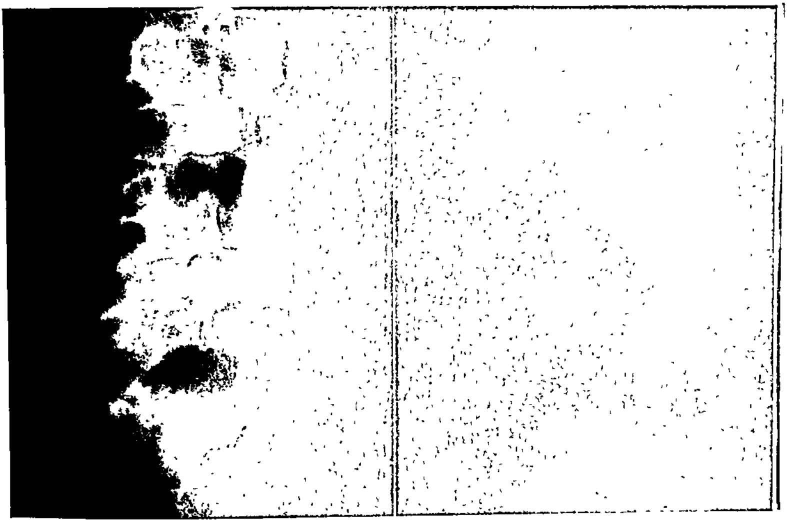

Fig. 3.—Discogram of a patient with no history of low backache. Here the three lower lumbar discs treated by injection show various morphologic stages of the nucleus pulposus. At the disc at L 3-4 fourth lumbar levels there is a bivalved, globular normal nucleus. At the disc L 4-5 the nucleus is multibranched, with posterior prolapse into the spinal canal. The nucleus of the lumbosacral disc is multilobulated, representing a type liable to progress to herniation.

by an osteophyte. Any hard resistance to penetration of the needle indicates that the needle has met bone, or the cartilaginous endplate of the vertebral body, neither of which should be forced or traumatized.

As a rule, the lumbosacral disc is first identified below the bifurcation of the large vessels. The full length of the needle is inserted into its substance, and as much Diodrast is injected as the disc will take with moderate pressure.

If there is a high bifurcation of the aorta and the inferior vena cava, the disc at L 4=5 might also be injected in the midline. In the majority of cases, however, it is injected on the left anterolateral sector of the spine alongside the aorta, while the index finger guards and slightly displaces the vessel toward the midline. The disc L 3=4 can be injected in a similar manner.

As soon as the needle penetrates the annulus, moderate pressure should be exerted upon the plunger of the syringe. This serves to counteract the intrinsic tension within the disc, which might force pulpous fluid back into the lumen of the needle, occluding it. Even the normal disc will accommodate approximately 0.5 to 1 cc. of fluid; therefore, resistance to the injection so strong that no fluid can be deposited implies either that the needle is occluded with precipitate or that its tip is embedded in the endplate of the vertebral body. Under such circumstances the needle should be withdrawn and its patency tested before it is reintroduced at a slightly different angle.

Immediately after the injections,

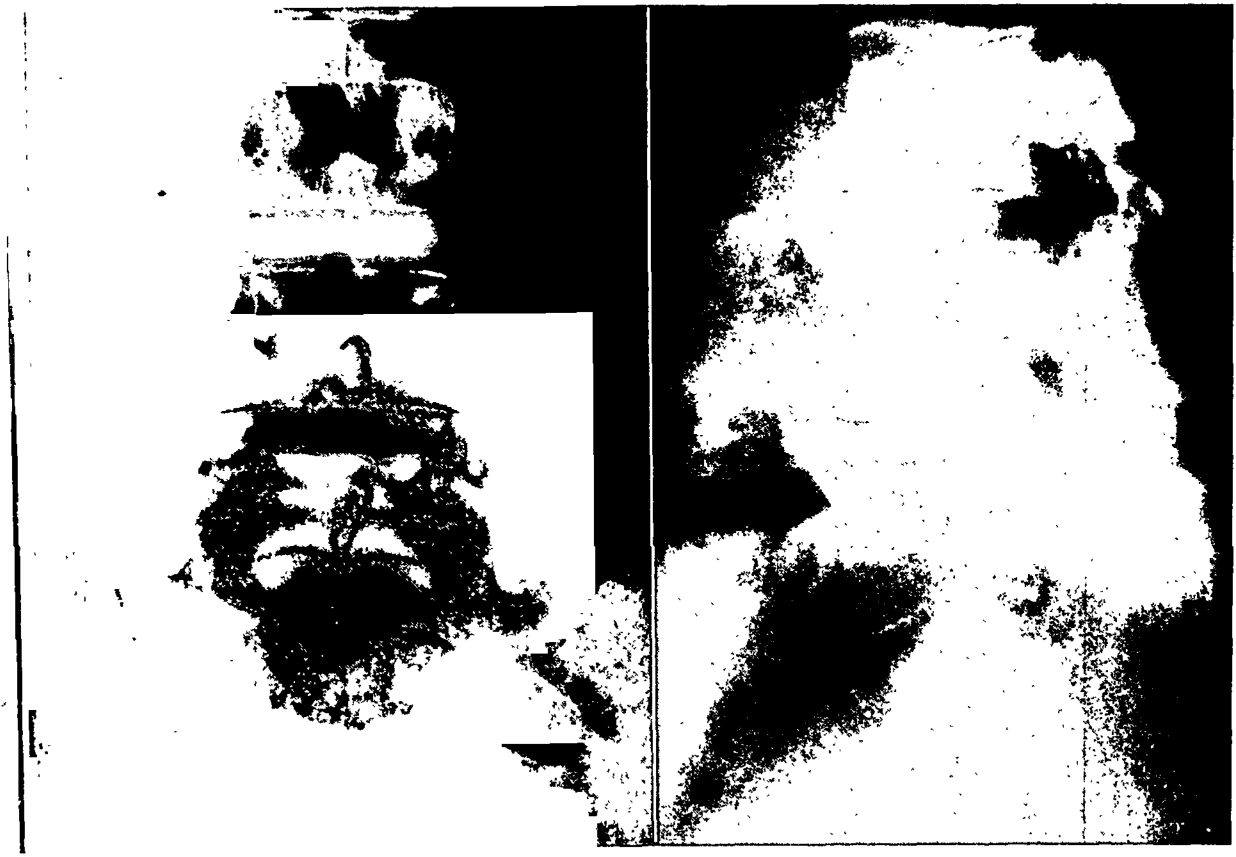

Fig. 4.—Discogram of a patient with a history of a short episode of low backache two years before discographic study. The discogram shows a normal nucleus at disc L 3-4, a flattened, lobulated nucleus with posterior prolapse at disc L 4-5, and a multibranched nucleus at the lumbosacral disc.

genograms are taken in the anteroposterior and lateral positions and the contemplated operation is carried through to completion (Figs. 1 to 5).

## COMMENT

A small series of transabdominal discographic examinations performed during pelvic operations has impressed me with the ease and speed with which injections of contrast medium into the lower lumbar discs can be accomplished. Both advantages are in marked contrast to the consumption of time and the repeated roentgen check-ups required before the opaque material can be injected into the pulpous nucleus by the posterior discographic technic.

No postoperative complaints referable to the discographic procedures were encountered in the present transabdominal series. This is understandable, since trauma to the soft tissues of the back and the periosteum of the spine by multiple needle stabs, and the repeated puncture transfixions of the epidural space or the dural sac—unavoidable features of the posterior epidural or transdural discographic study—are avoided by anterior injection of the contrast medium into the disc.

That transabdominal discographic examination can be performed only during a laparotomy is admittedly a limiting factor. Nevertheless, it gives the general surgeon and the gynecologist an excellent opportunity to investigate the status of the lower lumbar discs in patients with chronic low backaches, who for other rea-

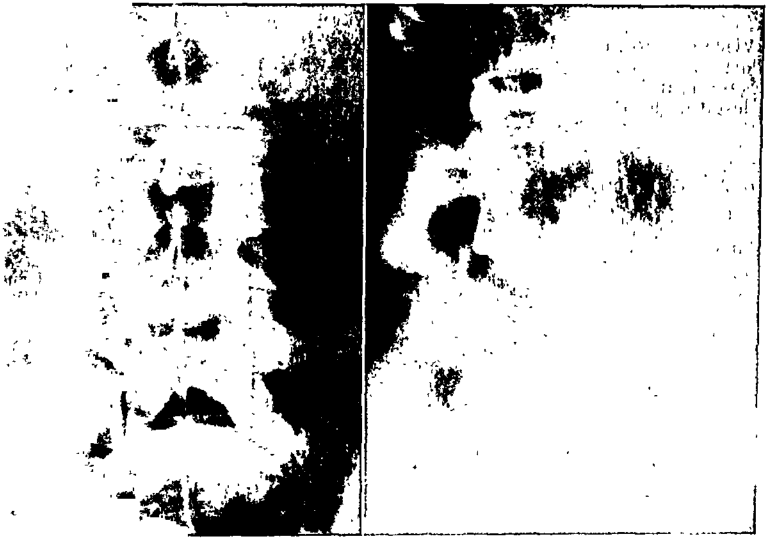

Fig. 5.—Discogram of a patient who, even upon the closest interrogation, could not recall an incident of low backache. She admitted severe cramps with pain around the waist during the first days of her menstrual periods. At the third and fourth lumbar level the discogram shows a flattened, multibranched nucleus with a mushroom-shaped, posteriorly extending deformity representing a clinically silent and structurally still incomplete rupture of the posterior segment of the annulus. The discs at L 4-5 and first sacral level present normal configuration.

sons undergo operations of the pelvis or the lower part of the abdomen.

### SUMMARY

*A technic for performing transabdominal* anterior discography as an addendum to lower abdominal operations is presented with the report of observations in 15 unselected cases.

### ZUSAMMENFASSUNG

Es wird eine Technik der röntgenologischen *Kontrastdarstellung* von Zwischenwirbelscheiben von vorn auf transabdominalem Wege gelegentlich von Unterleibsoperationen dargestellt und über die Beobachtungen an 15 nicht ausgewählten Fällen berichtet.

### SUMARIO

*O autor apresenta uma técnica para a* realização da discografia anterior transabdominal afim de completar operações abdominais inferiores, comunicando 15 observações de casos não selecionados.

### RESUMEN

Se presenta una técnica para llevar a *cabo discografía* anterior transabdominal como un suplemento de las operaciones de vientre inferior. Se comunican 15 observaciones de casos no seleccionados.

RIASSUNTO

Viene descritta la tecnica per la discografia anteriore transaddominale, da impiegarsi negli interventi sui quadranti inferiori dell'addome.

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The art of medicine was old before universities were founded, but the science of medicine is younger than all but the most recent of them. We often picture the development of medical science as the slow building up or deduction of knowledge from experience accumulated over many hundreds of years; but the fact is exactly the reverse. Medicine, in common with other sciences, began a *priori* with inductive reasoning from general assumptions about the nature of life and disease, and only gradually came to use what are now called scientific methods of experiment and observation. The scientific outlook, which has recourse to inquiry rather than assumption, appeared with the Renaissance, and inspired men like Vesalius and Harvey to spurn tradition and seek for truth.

—*Ogilvie*

# A New Method for Anesthetizing the Inferior Alveolar Nerve*

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IT is known that the mandibular rami may differ in length and width. Using a specially devised compass in normal subjects, I arrived at the conclusion that the space between the anterior and posterior borders of the rami differs widely. According to these measurements, except in the presence of pathologic conditions (dwarfism, gigantism or acromegaly, for instance), the difference between the widest ramus and the narrowest is about 18 mm.

According to various studies on the rami of naked mandibles,** the average width of the rami at the level of the foramen mandibulae may range from 22 to 40 mm. Since it is outside the scope of this presentation, I shall not here consider why these variations occur.

Photographs of different mandibles have shown that, even in the same person, the left and the right rami may differ in length and width.

When anesthetic solutions are to be injected into the mandibular foramen and when the oral route is used, one must first determine the depth of the mandibular foramen from the anterior border by measuring, after which the anesthetic should be administered accordingly. As a matter of fact, from the aforementioned studies of naked mandibles, the space from the anterior border to the foramen varies approximately from 14 to 28 mm. When alcohol is to be injected the importance of these measurements becomes clear. Even when one employs extra-oral injection through the posterior border, such measurements are essential.

When injection is through the lower border, since the length differs, one may think it necessary to measure the depth of the foramen; it is known, however, that the mandibular foramen is continuous with the mandibular sulcus under the foramen; therefore no measurements may be used.

On the basis of these observations I undertook to devise an instrument that could be used on patients to measure the width of the mandibular ramus between the anterior and posterior margins at the level of the foramen (B. Aksoy's compass, Fig. 1). The compass consists of two legs, one curved and fixed and the other straight and movable. I measure this width by applying the fixed leg of the compass to the posterior border of the ramus on the skin below the ear, the movable leg being inserted through the mouth to the anterior border. The resulting measurements therefore include the soft parts.

From the readings on both sides of the movable leg one can determine the width in millimeters. This having been done, it is easy to estimate the depth of the foramen. Studies on both living and dead subjects have shown a definite relation between the depth of the foramen and the width of the ramus. It was therefore concluded that the distance of the foramen from the anterior border is three-fifths the width of the ramus.

The distance from the deepest part of the mandibular notch to the lower border, on a line parallel with the posterior

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*Demonstration given at the International Dental Congress, London, England, July 24, 1952.

†Deceased. Formerly Director of the Institute of Oral Surgery, University of Istanbul.

**Nevin, M.: Length of Needle Insertion in a Mandibular Injection, Modern Dentistry 16, 1949.

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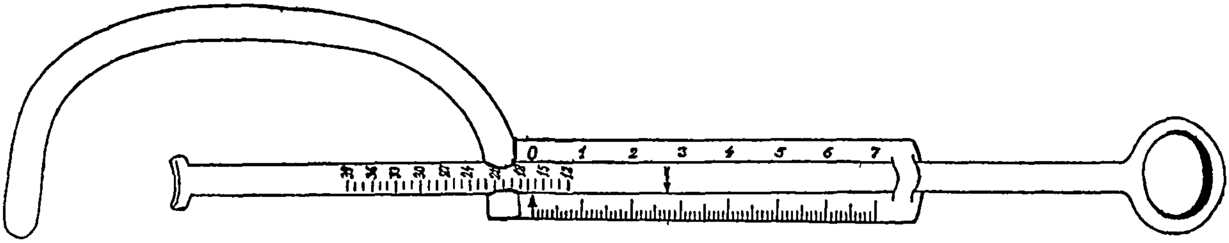

Fig. 1.—B. Aksoy's dividers for measuring the width of the rami in the living subject (see text for explanation).

border of the rami, differs also in different subjects. As has been mentioned, when the extra-oral lower border route is used, this longitudinal distance must be estimated to enable one to reach the foramen at the right point. This depth of the foramen from the lower border is also three-fifths of the measurement aforementioned. Thus it is clear that by measuring the depth and width of each ramus one can determine the exact location of the foramen by the following formulas: If F is used to show the depth of the foramen from the anterior border and L represents the length or width of the ramus, the formula is $F = \frac{3L}{5}$ (B. Aksoy's index).

For instance, if the width of the ramus is 35 mm., the foramen is situated 21 mm. from the anterior border $(\frac{35 \times 3}{5} = 21)$.

According to this formula (B. Aksoy's index) I prepared a second type of compass (a modification of the first), with a second scale on the movable leg to show, in millimeters, the depth of the foramen from the anterior border, so that there is no need to calculate the depth. By measuring, with any instrument, the length of the ramus, and using the same formula, one can estimate the depth of the foramen from the anterior border. For instance, if the length of the ramus from the mandibular notch (incisura) to the lower border of the ramus is 55 mm., the foramen is situated 33 mm. from the lower border. $(\frac{3 \times 55}{5} = 33)$.

One can also measure the depth of the foramen from the posterior border by changing the formula thus: $\frac{2L.}{5}$ If the width is 35 mm., the foramen is 14 mm. from the posterior border $(\frac{35 \times 2}{5} = 14)$.

Another idea that made intra-oral anesthesia very easy was the preparation of a mandrin (stilet). For anesthesia of the inferior alveolar nerve, using the oral route in order to plunge the needle to the determined depth, I prepared two types of mandrins to be used on curved needles. The mandrins are employed to determine the depth of the foramen from the anterior margin. They consist of metallic tubes (Fig. 2) to contain the needles and a vertical portion which is placed at the anterior border. I call this vertical piece "cursor-fix, syn. marking arm." On the end of the tube containing the needle there is a cap, which is used to fix the pavilion of the needle to the tube.

If every dental surgeon would make for himself this type of mandrin in his own laboratory, he could avoid buying ready-made mandrins. I advise the preparation of three mandrins, each of which has a tube 25 mm. long. The cursor should be fixed to the tube at different levels; on one of them 20 mm., on another 15 mm., and on the third 8 mm., from the distal tip. Through the tube of this mandrin I pass flexible and oxidation-proof needles 38 to 44 mm. long. Bending by hand will produce the length desired.

The second type of mandrin is more useful than the simple original version and more suitable for regulating the distance. The main difference is that in the second type the vertical marking arm (locating lug) can be moved open downward by a screw, and consequently the point of the needle can be brought precisely to the desired millimeter of depth. It is possible to obtain similar mandrins with movable marking arms (syn. cursor mobile) from the commercial market.

*B. Aksoy Method of Peroral Anesthesia of the Inferior Alveolar Nerve.*—The patient is seated in a dentist's chair. The ramus on the side on which anesthesia is desired is measured with the B. Aksoy special compass (Fig. 1).* If this shows that the point of the needle should be at a depth of 24 mm. from the anterior margin, then, with the aid of one of the mandrins (the simple type or the one with the movable marking arm) the needle and the arm are adjusted to 24 mm., the needle and mardrin being mounted on a 2 cc. Record syringe.

I keep the patient with the mouth wide open and the commissura labialis pushed aside by a mouth inspection mirror. After ascertaining the midpoint on the pterygomandibular raphe and assuring myself that the mandrin is at the right level, I inject a few millimeters of the solution at the point where the periosteum and the marking arm are estimated to be 8 to 10 mm. from the anterior border, in order to anesthetize the lingual nerve. The needle is then inserted until the marking arm touches the anterior border, after which the necessary amount of alcohol or anesthetic solution is injected.

## SUMMARY

When the intra-oral or extra-oral lower or posterior route is used for anesthesia of the inferior alveolar nerve, it is impossible to reach the exact site of the mandibular foramen without measuring the width or the length of the ramus in each case and on each side. Although anesthesia can be induced even when the solution is not injected at the exact site of the foramen, it is especially important that the exact site be reached when alcohol is employed. For this purpose the author has prepared a special compass to measure the width of the mandibular ramus and

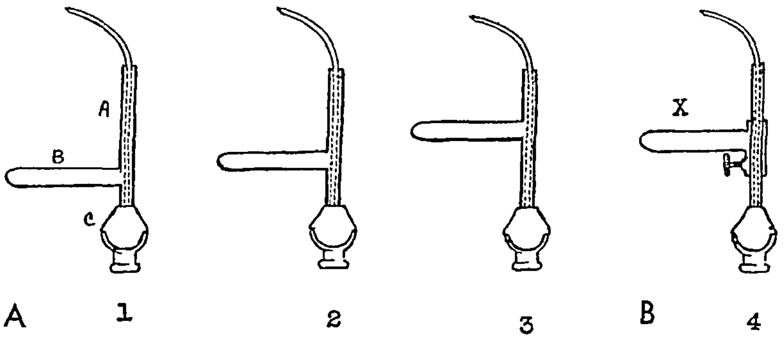

Fig. 2.—B. Aksoy's mandrins with fixed cursors carrying bowed needles. Each consists of a tube (*A*) through which the needles pass, a fixed cursor marking arm (*B*) vertical to this tube, and a cap (*C*) which is to be fixed upon the flaring end of the needle. The marking arm (*B*) is fixed upon the tube at point *1* at a distance of 20 mm., at point *2* at a distance of 15 mm., and at point *3* at a distance of 8 mm. from the distal tip. *B*, B. Aksoy's mandrin carrying a bowed needle and haying a movable marking arm (*B*). This movable cursor can be fixed at the desired depth from th terior margin by moving it up and down the tube.

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*As has been mentioned, the second type of compass shows both the width of the ramus and the depth of the foramen in *millimeters. This type is the more useful, as it* indicates the exact location of the foramen without calculation.

has set up a formula to calculate the exact location of the foramen. He has also prepared special mandrins (stilets) through which the solution can easily be injected at the correct point. This new method of anesthetizing the inferior alveolar nerve by the intra-oral route is in current use at the Institute for Oral Surgery in Istanbul.

### RÉSUMÉ

Il est impossible, lors d'anesthésie par voie extra ou intra-buccale du nerf dentaire inférieur, d'atteindre l'emplacement exact de l'orifice interne du canal dentaire inférieur sans mesurer sa longueur de chaque côté. Quoique l'anesthésie puisse être obtenue même si la solution n'est pas injectée à l'endroit précis de l'orifice, il est indispensable, pour les injections d'alcool, d'atteindre l'emplacement exact. Dans ce but, l'auteur a préparé, d'une part, un compas spécial qui peut mesurer l'étendue du nerf mandibulaire, et, d'autre part, une formule pour calculer l'emplacement de l'orifice interne du canal dentaire. Il a également confectionné un trocart à travers lequel il est facile d'injecter la solution à l'endroit désiré.

### ZUSAMMENFASSUNG

Bei der Anästhesierung des unteren Alveolarnerven auf intraoralem oder extraoralem unterem oder hinterem Zugangswege ist es unmöglich, die Stelle des Foramen mandibulare genau zu treffen, ohne in jedem Fall und auf jeder Seite die Breite oder Länge des Ramus zu messen. Anästhesie lässt sich zwar auch erzielen, wenn e Lösung nicht genau in das Unterkieferloch eingespritzt wird, bei Alkoholinjektionen jedoch ist das Treffen der richtigen Stelle wesentlich. Zu diesem Zweck hat der Verfasser einen speziellen Zirkel konstruiert, mit dessen Hilfe man die Breite des Kieferastes messen und eine Formel zur Errechnung des genauen Sitzes des Unterkieferloches aufstellen kann. Ausserdem hat er Kanülen gebaut, mit denen sich die Lösung leicht an der richtigen Stelle einspritzen lässt. Das Institut für Orale Chirurgie in Istanbul bedient sich jetzt dieser neuen Methode zur intraoralen Anästhesie des unteren Alveolarnerven.

### RESUMEN

Cuando se utiliza la vía posterior ó extraoral inferior en la anestesia del nervio dentario inferior, es imposible alcanzar el sitio exacto de foramen mandibular sin medir la amplitud y longtiud de la rama en cada caso y en cada lado. Aun cuando puede obtenerse anestesia cuando la solución no se inyecta en el sitio del foramen; empleando inyecciones de alcohol es esencial el lograr el sitio correcto. Para este proposito el autor ha preparado un compás especial que puede medir la amplitud de la rama mandibular y establecer una fórmula para calcular el sitio excato del foramen mandibular. Tambien ha preparado estiletes con los cuales se puede inyectar facilmente la solución en el sitio correcto. Este método nuevo para anestesia intraoral del nervio dentario inferior esta siendo usado actualmente en el Instituto de Cirugía Oral en Estanbul.

### RIASSUNTO

Quando, nel praticare l'anestesia del nervo alveolare inferiore, si segue la via intra- o extra-orale o posteriore, è impossibile raggiungere la sede esatta del foro mandibolare senza misurare la larghezza e la lunghezza del ramo mandibolare in ogni caso e da ogni lato. Per quanto l'anestesia possa essere ottenuta anche quando la soluzione anestetica non sia stata iniettata nella sede esatta del foro, allorchè si pratichino iniezioni alcooliche è d'importanza essenziale che tale sede sia esattamente raggiunta. Allo scopo l'autore ha preparato uno speciale compasso che misura la larchezza del ramo mandibolare e fornisce una formula capace di indicare la sede esatta del foro mandibolare Egli ha anche preparato aghi attraverso cui si può facilmente iniettare la soluzione nel punto giusto.

# Spontaneous Intracerebral Hematoma

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SPONTANEOUS (nontraumatic) intracerebral hematoma is now being widely recognized as a type of "stroke" calling for surgery in selected cases. Aring[1] has announced, "The only treatment of any avail is surgical removal." Odom, Bloor and Woodhall[2] have stated, "All of the resources of the neurosurgical armamentarium should be used toward the operative relief of patients with an intracerebral hematoma." Grant,[3] Scott,[4] Browder,[5] and others, after study of large series of cases have all favored a well-considered operative approach.

The problem is a pressing one, since Scott[4] has pointed out that "stroke" has risen to fourth place among causes of death. Falconer[6] has estimated that 80 per cent of those who suffer from intracerebral clot die within two to twenty-four hours of onset and has declared that cerebral hemorrhage is the principal killing disease of the nervous system. He adds, "Many of these deaths undoubtedly could be prevented." De Takats and Graupner[7] recorded the mortality rate at 77 per cent.

The problem is not simply the reduction of mortality. The question most frequently posed by the family is whether, if the patient recovers, he will be paralyzed or mentally impaired. The family physician wants to know whether or not a recurrence can be expected in a very short time if the patient survives. Aring[1] has pointed out that recurrence is not the rule. Others have shown they occur in only about 10 per cent. Margolis and his associates[8] have demonstrated in at least some of these patients that the hemorrhage is the result of a small angiomatous malformation, which is usually destroyed either by the hemorrhage or by surgical intervention.

The outlook as to lasting morbidity is a more distressing problem. Some have wished to predicate selection for operation on a basis of age. Experience has shown that arbitrary selection of only patients below 50 years of age is grossly unfair to many victims of the disease, because, while the age factor is certainly relevant, it is not of primary importance. Five other considerations are at least equally important. The first is whether or not the patient is initially in coma. The vast majority of patients with spontaneous intracerebral bleeding have an apoplectic onset with coma; the prognosis is better for those who do not. The second is whether or not those who have an onset with coma begin to show some evidences of neurologic improvement within twenty-four to forty-eight hours. Browder and Corradini[5] have pointed out the favorable indications of such improvement when surgical treatment is undertaken. The third is whether or not a definite source of the bleeding can be demonstrated, such as an aneurysm or an angioma, and whether or not this source is operable. The fourth is the location of the hematoma; a clot in the temporal lobe, far frontal, or in the occipital lobe being far more favorable than one in the internal capsule and the basal ganglia. Fifth, and perhaps most important, is whether or not the patient has a history of widespread cardiovascular-renal arteriosclerotic disease and shows the characteristic signs thereof, with or without hypertension. In fact, hypertension may be a temporary concomitant of the "stroke." Given a patient with intracerebral hematoma, but without history or signs of cardiovascular-renal sclerosis; who has not lapsed into

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From The Neuroclinic, Atlanta.
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coma or whose state of consciousness is improving; who has a demonstrable aneurysm on the affected side; and whose clot is in the far frontal or temporal lobe, especially if on the right, this patient deserves operation even if he is over 60. It might be added, for those who think of intracerebral clot as almost always occurring in the internal capsule, that Grant and Austin[3] found from one-third to one-half in the temporal lobe.

## REPORT OF CASES

CASE 1.—A 67-year-old white woman became mentally confused while at church. She was taken home, where she vomited for one week. Between the seventh and ninth days there was some improvement in her mental status and she was able to recognize her relatives, but she was unable to retain any food and had to be fed intravenously. She had difficulty in raising her left arm. Her past history was not suggestive of serious arteriosclerotic disease. Examination revealed a left homonymous hemianopsia and a left hemiparesis; examination of the fundi discovered no papilledema and no evidence of arteriosclerosis. Ventriculographic examination (Fig. 1) showed absence of the right temporal horn of the lateral ventricle. On craniotomy a large clot was aspirated from the temporal lobe. Two and one-half years later, except for a tremor of her head, neurologic examination gave negative results.

*Comment.*—This patient's age was overbalanced by the factors that she was never in coma, that she tended to improve, that her clot was in the temporal lobe and that she showed no evidence of generalized arteriosclerosis.

CASE 2.—A 47-year-old woman, known to be hypertensive, suffered a sudden onset of deep coma. She had complete right hemiplegia. The fundi showed no papilledema and no evidence of sclerotic vessels. The spinal fluid pressure was above 300 mm. of water, and angiographic investigation demonstrated a frontal intracerebral mass (*Cr*, Fig. 2). At craniotomy a sausage-shaped hematoma traversing the entire left frontal lobe from front to back was evacuated. The postoperative course was stormy, but two years later the patient was neurologically intact and managing her own business.

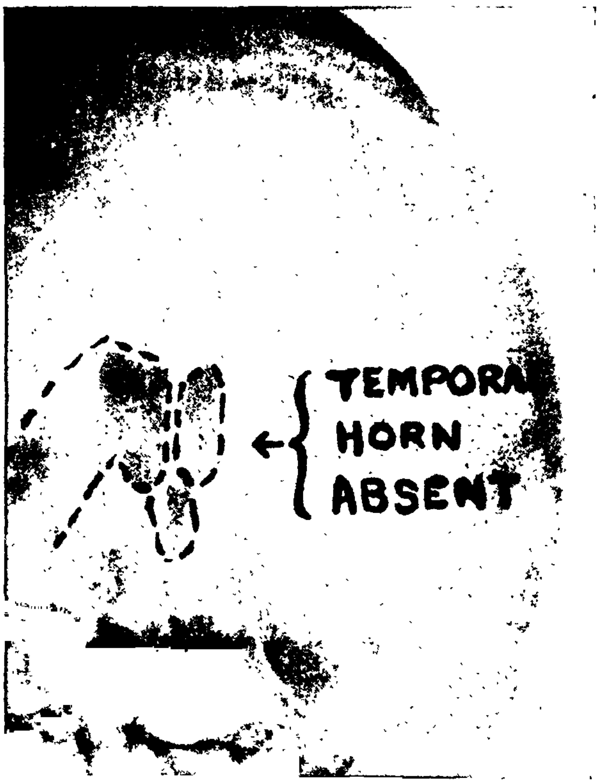

Fig. 1.—Ventriculogram showing absence of right temporal horn.

CASE 3.— A 52-year-old white man had a sudden onset of headache, aphasia and disorientation. Various diagnoses, including hysteria and meningitis, had been considered. An angiogram showed a space-taking lesion in the left temporal lobe and an aneurysm of the left middle cerebral artery. At craniotomy the clot was evacuated and the aneurysm clipped off. Ten months after the operation the patient was symptom-free and back at work.

CASE 4.— A 43-year-old woman had a sudden and severe onset of headache. She began to vomit, and fell, owing to weakness of the left arm and leg. She became disoriented. Her past history was free of symptoms of renal or cardiac disease, and she had never had hypertension. A ventriculogram revealed a space-taking lesion in the right temporal lobe, which proved to be an intracerebral hematoma and which was removed at craniotomy. Two months later she was much improved and able to come to the office. She still showed a mild weakness of the left side and left homonymous hemianopsia.

CASE 5.—A 62-year-old white man had a severe pain in the right side of his head and became temporarily unconscious. On his re-

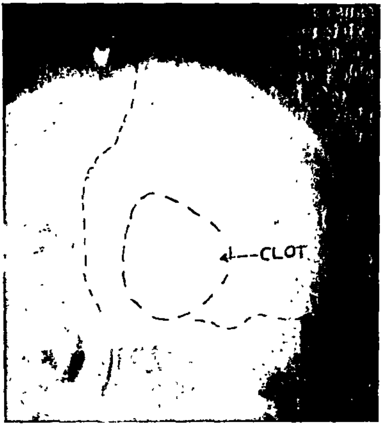

Fig. 2.—Frontal mass which proved to be a hematoma traversing the entire frontal lobe.

gaining consciousness, his family noticed that he had a right-sided facial weakness, slurred speech and difficulty in swallowing. This patient was known to be hypertensive, and cardiac disease was suspected. He had at times suffered from dynspnea and ankle edema.

Examination revealed left homonymous hemianopsia, a marked left hemiparesis, and partial aphasia. The fundi showed far advanced arteriosclerosis. The spinal fluid pressure was 290 mm. of water, and the fluid was bloody. A ventriculogram (Fig. 3) indicated a space-taking lesion in the temporal area. A left temporal clot was found and removed at craniotomy. One year later he had a serious recurrence.

*Comment.*—In addition to his age, this patient had unmistakable evidence of severe arteriosclerotic disease. This combination renders the subject unfavorable for operation.

CASE 6.—A 49-year-old white male had extreme hypertension of ten years' duration. He had lost 5 siblings in recent years from cerebrovascular accidents. In addition, his father and two maternal aunts had died from this cause. Two weeks before examination he had evidently become confused and had driven into the back of another car. Severe headache ensued. He improved for forty-eight hours, after which time there developed right hemiparesis and some speech disturbance. His state of consciousness from then on deteriorated steadily. When he was first seen by us he was deeply comatose, was hyperventilating and had a rattling type of respiration. Ophthalmoscopic examination revealed left papilledema and several small retinal hemorrhages, but no evidence of arteriosclerosis. The spinal fluid pressure was 470 mm. of water. While awaiting operation he went into decerebrate rigidity. A left temporal craniotomy was done, with removal of an intratemporal hematoma. When last seen, five months later, he was leading an active life and driving his own car.

## SUMMARY

1. Age over 50, as a single factor, does *not necessarily contraindicate operation* for spontaneous intracerebral hematoma.
2. Hypertension, although extreme and of long standing, does not in itself constitute a contraindication.
3. Five other factors influence the decision for or against surgical intervention, *namely, whether or not the patient is ever* in coma; whether or not, if in coma, he tends to show improvement; whether or not a demonstrable cause of the hemor-

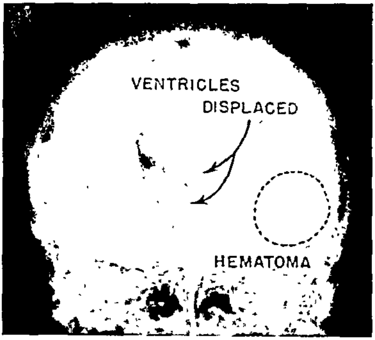

Fig. 3.—Ventriculogram showing a space-taking lesion in the temporal area, which proved to be a clot and was removed at craniotomy.

rhage, such as aneurysm or angioma, is present; whether or not the hematoma lies in a location favorable for surgical approach; and, most important, whether or not the history and the results of examination indicate the presence of generalized arteriosclerotic disease.

### ZUSAMMENFASSUNG

1. Ein Lebensalter von mehr als fünfzig Jahren stellt als einzelner Faktor nicht unbedingt eine Kontraindikation der Operation eines spontanen Blutergusses im Gehirn dar.

2. Auch die Blutdruckserhöhung, selbst wenn sie extrem ist und lange besteht, bildet an und für sich keine Kontraindikation.

3. Die Beantwortung fünf anderer Fragen spielt bei der Entscheidung für oder gegen den chirurgischen Eingriff eine Rolle, nämlich
(a) ob der Patient im Koma ist,
(b) ob er, wenn im Koma, Neigung zur Besserung zeigt,
(c) ob sich eine Ursache der Blutung wie z. B. ein Aneurysma oder ein Angiom nachweisen lässt,
(d) ob die Lage des Hämatoms für einen chirurgischen Zugang günstig ist, und
(e) ob (sehr wichtig!) die Untersuchung das Bestehen einer allgemeinen Schlagaderverkalkung ergibt.

### RESUMEN

1. La edad sobre 50 años como factor único no constituye necesariamente una contraindicación para la operación del hematoma intracraneal.

2. La hipertensión, aun intensa y de larga duración no constituye por si misma una contraindicación.

3. Los otros cinco factores que intervienen en la desición operatoria son, si el paciente esta ó no en coma, si esta en coma si tiende a mejorar, si existe una causa demostrable de hemorragia ó no, si existe un aneurisma ó angioma, si el hematoma esta situado ó no en un sitio favorable para el abordaje quirúrgico, y lo que es más importante si la historia ó la exploración física indica la existencia de arterioesclerosis generalizada.

### RÉSUMÉ

1. L'âge (plus de 50 ans) ne doit pas être pris en considération comme seul facteur pour une contre-indication de l'opération de l'hématome intracérébral spontané.

2. L'hypretension, même extrême et d'une longue durée, ne constitue pas en elle-même une contre-indication.

3. Cinq autres facteurs influenceront l'indication ou la contre-indication opératoire : le patient est-il dans le coma ou non ? En cas de coma, présente-t-il une amélioration ou non ? présence ou absence d'un symptôme d'hémorragie, tel qu'un anévrisme ou un angiome; l'hématome est-il localisé à un endroit favorable pour l'intervention chirurgicale ? La présence d'une artériosclérose généralisée décelée par l'anamnèse et l'examen du malade est le facteur de plus important.

### RIASSUNTO

1. Un'età di oltre 50 anni non controindica, di per se stessa, un intervento per ematoma intracerebrale spontaneo.

2. Uno stato ipertensivo, anche se molto accentuato e di lunga data, non rappresenta di per sè stesso una controindicazione.

3. Cinque altri fattori, viceversa, indicano o controindicano l'intervento. E sono: se il paziente è, o non è, ancora, in coma; se il coma tende, o meno, a regredire; se è dimostrabile, o meno, la causa dell'emorragia (come un aneurisma o un angioma); se la sede dell'ematoma è chirurgicamente raggiungibile, o meno; e, sopratutto, se l'anamnesi e l'esame obbiettivo indicano, o meno, la presenza di uno stato arteriosclerotico generalizzato.

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Some years ago I took part in one of those mass consultations which only the very rich or the very important are unfortunate enough to demand. I say this with no trace of cynicism, for when many experts meet together, either they agree, in which case the same verdict would have been reached more quickly and cheaply by one of them acting alone, or they disagree, and the line of action finally decided upon is not the clear-cut and definite decision of one mind, but a compromise representing the modicum of agreement, remaining after conflicting views have cancelled out. In this case the patient was an eminent scientist affected with severe diabetes, and also the victim of an enormous carbuncle, which had been excised. There were present besides myself, a pathologist, a bacteriologist, two titled physicians, another surgeon and the general practitioner. Discussion ranged around cardiac stimulants, vaccines, staphylococcal sera, injections of colloidal metals, intravenous antiseptics, immuno-transfusions and further surgery. (This was before the days of chemotherapy.) We had before us charts, and blood tests of every description. Meanwhile Lord Horder sat by himself studying the nurse's report book, and elucidated the clinical fact that was of far more importance than all these laboratory measures—that the intake of fluids had for some days been grossly insufficient, and that the urine output had fallen to 8 to 10 ozs. in the twenty-four hours.

—*Ogilvie*

# Venous Angioma: A Cause of Cerebral Palsy*

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IN a previous paper,[1] I reviewed the outstanding work of William Sharpe[2] on the pathologic aspects of cerebral birth palsy. He gave incontrovertible proof that about 9 per cent of newborn children show blood in the spinal fluid at birth. The cerebrospinal fluid was obtained by lumbar puncture of newborn children in the first twenty-four hours of life. He showed in this series of 500 lumbar punctures that the bloody cerebrospinal fluid in many cases was observed in children who had been delivered without instruments. It is Dr. Sharpe's contention,[2] with which I wholly agree, that cerebral birth palsy would be obviated in many cases if spinal punctures were carried out in all cases of suspected neonatal intracranial bleeding. In some cases of massive intracranial bleeding, craniotomy, with evacuation of the clot within the first few days, gave excellent results in Dr. Sharpe's hands.

The present paper deals with the surgical pathologic picture and the short-term postoperative results in a small series of cases. The patients selected for this demonstration showed the clinical picture of cerebral birth palsy. It is my opinion that the pathologic condition observed at operation was caused in every case by moderate intracranial hemorrhage at birth. In Case 2 it may have been due to meningitis.

In my experience, children who show the clinical picture of cerebral spastic paralysis are of two types. One type, by far the more numerous, shows adhesive arachnoiditis and arborization of abnormally large veins—usually one wide vein with many branches leading into the main trunk. The vessels are often accompanied by thin arteries and feed into a venous lake or aneurysm, which may invade the cortex up to 1 inch (2.5 cm.) or more in depth. These vessels are observed in the motor area just above the sylvian fissure and are usually in the dominant cerebral hemisphere. On the opposite cerebral hemisphere there is usually arachnoiditis, with a slight increase in the number of cortical veins. The brain, upon being exposed after the opening of the dura mater, is at first dusky, bulging and nonpulsating. Within ten to fifteen minutes the brain becomes pinkish and begins to pulsate normally. There is very little cerebrospinal fluid when the dura mater and arachnoid membranes and adhesions are incised. However, the flow usually becomes free shortly after the brain begins to pulsate.

When the abnormal cortal veins, which constitute what may be called a venous angioma, are cauterized with coagulating current, the brain recedes from the craniotomy opening and no longer shows the signs of abnormal intracerebral pressure. This happens within fifteen to twenty minutes after cauterization of the vessels.

In 1 of the 8 cases in this series there were signs of block in the fourth ventricle. This block was partial and was associated with hydrocephalus, as well as with spasticity of all limbs. The cause of the obstruction was adhesive arachnoiditis.

When the dura mater was exposed over the cerebellar lobes, the dura was bluish, bulging and nonpulsating. When the dura was incised in a stellate manner, the right cerebellar lobe was depressed and nonpulsating. There was a slow dribble of cerebrospinal fluid, which changed to a rush of fluid under pressure when the walls of the cyst were disrupted. The flow from the fourth ventricle then became free; the cerebellum began to pulsate normally, and the bluish color of the cerebellum changed to pink. The depressed cerebellar lobe be-

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Most of the patients in the cases reported were treated at the Mother Cabrini Memorial Hospital.

gan to rise toward the craniotomy opening.

In 2 patients who died shortly after operation the cortex and white matter were of normal thickness despite the fact that 1 of the deceased patients had had moderately severe hydrocephalus as well as all the signs of cerebral palsy, involving all four limbs.

The clinical pathologic manifestations in all the cases consisted of motor aphasia and spastic quadriplegia. Intelligence could not be adequately tested because of the severity of the spasticity and the concomitant aphasia. The children ranged in age from 9½ months to 8 years.

### *REPORT OF CASES*

Case 1.—A. G. T., a boy 9½ months old, had undergone breech delivery. The diagnosis of intracranial hemorrhage was made a few days after birth. Spastic quadriplegia was present, more severe on the left side. Elevated intracranial pressure was noted on examination. The baby was mentally retarded. The operative pathologic picture consisted of right-sided venous angioma at the lower end of the motor area, involving the sylvian fissure and the undersurfaces of the temporal and frontal lobes. Postmortem examination showed the aforementioned pathologic changes, with an otherwise normal cortex and normal ventricles. The cause of death was medullary edema following operation.

Case 2.—P. J. S., a boy aged 2½ years, had laryngeal spasm, hydrocephalus, spastic quadriplegia, mental retardation and motor aphasia, which came on gradually after the age of 11 months. Elevated intracranial pressure was observed on two occasions by spinal tap. At operation there was an adhesive arachnoiditis cyst blocking the fourth ventricle. At autopsy, dilated ventricles and remnants of adhesive basilar arachnoiditis were observed. The cerebral cortex and the white matter were within normal limits. The brain was heavier than normal. The cause of death was bronchopneumonia.

Case 3.—D. R. S., a girl aged 8 years, had been injured at delivery. Bloody cerebrospinal fluid was observed on lumbar puncture a few days after birth. The patient was of the quadriplegic-clonic athetoid type. Clonic spasms involved the face as well as the limbs. The child had aphasia and laryngeal spasm, with difficulty in breathing and swallowing. Bilateral temporoparietal craniotomy revealed a left venous angioma in the lower portion of the motor area, with adhesive arachnoiditis. At the time of writing this child has improved enough to be admitted to a school for special training.

Case 4.—G. K. Jr., a boy aged 2½ years, had cerebral palsy, diagnosed at a university medical center when he was 7 months old. Spastic quadriplegia, aphasia, epilepsy, amblyopia, mental retardation and elevation of the intracranial pressure were observed. The brain, viewed through a left frontoparietal craniotomy, showed adhesive arachnoiditis and venous angioma over the left motor area, just above the lower end of the sylvian fissure. At the time of writing the child's vision has improved. He recognizes his parents, laughs normally and eats well. He has had no convulsions since the immediate postoperative period and is no longer spastic.

Case 5.—P. J. H., a girl 3 years old, was born prematurely. She was in the hospital for three months and in an incubator for eight weeks. She had spastic quadriplegia, motor aphasia, difficulty in breathing, mental retardation and signs of increased intracranial pressure. Surgical investigation through a left frontoparietal craniotomy revealed adhesive arachnoiditis, with a venous angioma in the lower portion of the motor area and involving the lower portion of the sylvian fissure. At the time of writing this patient is able to take steps with help, is not spastic and shows mental improvement.

Case 6.—P. A. A., a girl aged 2 years, had cerebral spastic paralysis and was mentally defective and epileptic. At operation, angiomatous veins and adhesive arachnoiditis were observed in the left premotor area. The operative results are promising. The patient tries to walk and is no longer spastic. She had one epileptic attack after the operation but has had none since.

Case 7.—A. W., a boy aged 6 years, had cerebral palsy, gross mental deficiency, epilepsy and an asymmetric skull. Operation revealed left adhesive arachnoiditis and venous angioma. The results of treatment are promising. One postoperative epileptic attack occurred while the patient had measles, but none have occurred since then. Mental and motor power are improvi [illegible] and [illegible] sticity has greatly diminished.

Case 8.—J

mentally deficient and had cerebral palsy. Operation revealed a venous angioma in the left premotor area. The results of operative treatment are promising. The child is no longer spastic, and both mental and motor power show improvement.

### COMMENT

Eight children with cerebral palsy of the spastic quadriplegic type were operated upon. Seven of the 8 patients could not sit up before the operation. The first patient of this series was operated on less than four months prior to the time of writing. In all cases adhesive arachnoiditis was present. In 1 case, hydrocephalus and the clinical picture of spastic quadriplegia were caused by an arachnoiditic cyst blocking the fourth ventricle. In the other 7 cases, adhesive arachnoiditis surrounding a venous angioma of the lower portion of the motor area was observed. The brain had a bluish cast. The pathologic changes were in the dominant hemisphere as a rule. In the child who underwent a bilateral craniotomy, adhesive arachnoiditis was present only on the opposite side. It is my opinion that only children with a moderate amount of intracranial bleeding live long enough for cerebral palsy to develop, and that nature tries to combat the bloody exudate by setting up an abnormal, localized system of cortical and subcortical veins which cause abnormal cerebral physiologic conditions through local congestion, edema, and hypoxia. When the bloody fluid is absorbed, arachnoiditic adhesions and abnormal veins are formed.

The surgical procedure is as follows:

1. An opening about the size of a half dollar is made over the lower end of the sylvian fissure. This is over the dominant lobe, usually. However, clinical observations, and diagnostic tests will help the surgeon to identify the side to be operated on. Both sides are treated if the brain does not pulsate normally, if normal color does not appear after electrocauterization of the vessels or if the brain shows signs of tension.
2. The branches of the middle meningeal vessels are cauterized, and the dura mater is opened in a stellate manner.
3. On incision of the dura mater, the abnormal vessels often bleed profusely. Nevertheless, they should be exposed and cauterized with the electrocautery. There is often a venous lake, which must be cauterized to its depth.
4. The dura mater is left open.
5. The temporal muscle is repaired with separate silk sutures. The fascia is left open.
6. The skin is repaired in one layer with separate silk sutures.

Before the operation a cutdown on a vein should be done if necessary, so that blood can be given promptly. Anesthesia is started with open drop ether and goes on to light intravenous sodium pentothal. Procaine hydrochloride is injected at the site of incision.

The promising results obtained far thus convince me that this procedure merits further trial.

### SUMMARY

Eight cases of cerebral palsy are described. In 7 of the cases cerebral venous angioma, arachnoiditis and hypoxia of the brain were present. In 1 case there was an arachnoiditic cyst partially blocking the fourth ventricle and causing hydrocephalus and cerebral palsy.

Electrocauterization of the angioma resulted in better oxygenation and normal pulsation of the brain. Clinically, the 6 surviving patients showed definite improvement in spasticity and motor power. Mental status was improved in the mentally deficient children, and epilepsy was improved or totally eliminated in the epileptic children.

**Author's note:** Dr. Hyman Goldstein gave immeasurable help by his evaluation of the mental status in this series and by his posthospital pediatric care.

### ZUSAMMENFASSUNG

Es werden acht Fälle von zerebraler Lähmung beschrieben. In sieben Fällen

handelte es sich um ein venöses Angiom mit Arachnoiditis und Sauerstoffverarmung des Gehirns. In einem Falle verlegte eine arachnoiditische Zyste teilweise den vierten Ventrikel und führte zu Hydrozephalus und zerebraler Lähmung.

Elektrokauterisierung des Angioms führte zur Verbesserung der Sauerstoffversorgung und zu normaler Pulsierung im Gehirn. Die sechs überlebenden Patienten zeigten klinisch ein deutliches Nachlassen der Spastizität und eine Verbesserung der motorischen Funktion.

## RÉSUMÉ

L'auteur décrit huit cas de paralysie d'origine cérébrale. Sept de ces cas présentaient un angiome veineux cérébral, une arachnoïdite et une hypoxémie du cerveau. Dans un cas on trouva un kyste arachnoïdien bloquant partiellement le quatrième ventricule et causant de l'hydrocéphalie et de la paralysie d'origine cérébrale.

L'électro-coagulation de l'angiome provoqua une oxygénation meilleure et une pulsation normale du cerveau. Les six malades survivants montrèrent cliniquement une amélioration dans la spasticité et dans la motilité.

*L'état cérébral fut amélioré chez des* enfants mentalement déficients, et chez des enfants épileptiques on constata une disparition partielle ou totale des crises épileptiques.

## RIASSUNTO

Vengono descritti 8 casi di paralisi muscolare cerebrale. In 7 di essi vi era un angioma venoso cerebrale, con aracnoidite e ipossia del cervello. In 1 caso vi era *un'aracnoidite cistica che bloccava parzialmente* il IV ventricolor ed era causa di idrocefalo e paralisi.

L'elettrocoagulazione dell'angioma condusse ad una miglior ossigenazione del cervello e alla comparsa di pulsazioni normali. Clinicamente i 6 pazienti che sopravvissero presentarono un netto miglioramento dello stato spastico e della forza.

## RESUMEN

Se describen ocho casos de parálisis cerebral. En siete de ellos se encontraron angioma venoso, aracnoiditis e hipoxia cerebral. En uno se encontró un quiste aracnoideo bloqueando parcialmente al cuarto ventrículo y produciendo hidrocefalia y parálisis cerebral.

La electrocauterización del angioma produjo una mejor oxigenación y pulsatilidad normal en el cerebro. Clínicamente, los 6 pacientes supervivientes mostraron una *mejoría definida en la espasticidad y poder* motor.

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# Cerebral Venous Angioma Treated by Electrocautery

## Report of a Case

SAMUEL ROSNER, M.D., F.I.C.S.

NEW YORK CITY, NEW YORK

CEREBRAL venous angiomas are essentially of three types: (a) the simple varix, (b) the serpentine varix and (c) the racemose or cirsoid varix.

They are usually associated with nevi of the face or body. These varicosities may cause changes in the retinal veins, which become tortuous. In some cases buphthalmos may occur, with cerebral venous angioma. This is known as the Sturge-Webber syndrome. The buphthalmos is associated with cerebral venous angioma on the same side.

The cerebral venous angioma is not a neoplasm in the strictest sense of the word, yet it causes signs and symptoms compatible with cerebral neoplasm. Headaches, personality changes, and epileptic attacks are often associated with cerebral venous angioma.

The patient in many cases of cerebral angioma is referred to the radiologist for high voltage roentgen treatment. This type of treatment is often successful. My one objection is that sometimes cerebral necrosis occurs in the area of irradiation. In my opinion, therefore, this method of attack is to be used only when surgical repair of the condition is not feasible.

The following case is interesting because of the objective observations and the response to treatment.

E. G., a right-handed man aged 50, was admitted to the hospital on Aug. 14, 1952. He was brought into the hospital because of a generalized convulsion that had occurred at home.

While in the hospital, the patient had three generalized attacks. During each attack his eyes would turn to the right; there was vomiting, but no localizing signs were observed except the ocular rotation to the right side.

The history of past illnesses was noncontributory. A close relative volunteered the information that there had been signs indicative of some personality changes for two years prior to the epileptic episodes; whereas the patient had been an extremely kind, considerate person all his life, during the past two years he had become very irritable over little things. He had showed loss of memory and had indulged in alcoholic beverages frequently.

During the examination the patient was cooperative but confused, and cerebration was dull. He had been given anti-epileptic medication prior to the examination.

*Neurologic Observations.*—There was mild weakness of the central type in the seventh and twelfth nerves on the right side. Abdominal reflexes were absent, and bilateral positive Babinsky reactions were noted. In all other respects the results of neurologic examination were within normal limits.

Pneumoencephalographic investigation was carried out by means of lumbar puncture. The cerebrospinal fluid was clear and under pressure. The Pandy test gave a positive result.

The roentgenograms showed the lateral ventricles to be dilated. The right lateral ventricle was not distorted, but the left ventricle showed the occipitotemporal horns to be pushed toward the midline, with partial obliteration of the posterior pole; the left temporal horn was almost completely obliterated.

It was my opinion that the history, signs and symptoms were compatible with cerebral neoplasm in the left temporo-occipital region. There was one interesting observation: definite atrophy of the brain, as shown by pneumoencephalographic examination, was present.

A few days after the pneumoencephalographic procedure the patient was reexamined.

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There was Rombergism to the right, the patient walked on a wide base and showed left homonymous quadrantic loss of visual fields. This was determined by confrontation test.

On Aug. 23, 1952, the patient underwent left *temporoparieto-occipital craniotomy.*

*Craniotomy.*—A left-sided craniotomy was performed. A 3-inch (7.5 cm.) linear incision was made from the temporal region, running toward the left parietal eminence. The skull showed bluish discoloration in the area of incision. The bone was vascular. An opening in the skull somewhat larger than a silver dollar was made. This was centered at the upper end of the fissure of Sylvius. The dura showed dark blue discoloration in this area. The dura was incised in a stellate manner. Four large veins, almost 1 cm. in diameter, converged in a central lake at the upper angle of the fissure of Sylvius. Each vein was cauterized from its extremity inward toward the confluence of veins. Each vein in turn bled profusely when the cautery tip entered its bed. It was possible, in each case, however, to pick up the vein with a hemostat and complete the coagulation within a few seconds.

The incision was closed with temporal muscle and skin. The patient was sent back to bed in good condition. He was given 1 pint of blood postoperatively and reacted well thereafter.

*Postoperative Course.* — Cerebration was greatly improved. Insight into the problems the patient would have to face was good. Walking and balance improved. Speech was rational and had improved in clearness. There were no postoperative epileptic attacks in the hospital, and the patient was discharged on the eighth postoperative day. After a protracted convalescence, the patient at the time of writing, one and one-half years after the operation, is completely free from epileptic attacks. He is talking Dilantin (gr. 3) daily. Cerebration is improved and adequate, and there has been no further deterioration in behavior.

## SUMMARY AND CONCLUSIONS

The author reports a case of cerebral venous angioma in a man aged 50, treated by electrocautery.

This type of patient is usually treated by high voltage roentgen therapy, but, since cerebral necrosis sometimes is associated with this type of treatment, he prefers direct attack when possible.

A point of interest is the fact that the pneumoencephalogram was indicative of a space-occupying lesion. This would indicate that venous angiomas cause local cerebral edema.

Also significant is the fact that the complete obliteration of veins leading into the point of confluence of the varices did not cause any cerebral upset or loss of function, but rather resulted in almost immediate improvement. This would tend to prove that another means of venous drainage came into function almost immediately.

The final point is the rapid postoperative improvement observed in the neurologic and psychic status of the patient, despite the fact that there was definite brain atrophy, as shown in the pneumoencephalogram. The history of alcoholism was also a significant point with regard to the brain atrophy and the postoperative improvement.

## RÉSUMÉ ET CONCLUSIONS

L'auteur décrit un cas d'angiome veineux cérébral chez un homme âgé de 50 ans, traité par *électro-coagulation.*

## ZUSAMMENFASSUNG

Der Verfasser berichtet über einen mit Elektrokauterisierung behandelten Fall *eines zerebralen venösen Angioms* bei einem fünfzigjährigen Manne.

## RESUMEN Y CONCLUSIONES

El autor comunica un caso de angioma *cerebral venoso en un hombre de 50 años* de edad tratado por electrocauterio.

## CONCLUSIONI RIASSUNTIVE

L'autore riporta un **caso di** angi venoso cerebrale in un **uomo di 50** trattato con elettro-**cauterio.**

# Diastematomyelia

EDWARD MARTIN GATES, M.D., F.A.C.S., F.I.C.S.,

AND JAMES A. MORTON, M.D., F.A.C.R.

PONTIAC, MICHIGAN

DIASTEMATOMYELIA is a developmental malformation in which the spinal cord or cauda equina is divided into two parts. Duplication is generally effected by the presence of a midline division of the spinal canal by a boney or fibrocartilagenous septum arising from the posterior surface of the vertebral body and passing dorsal through the spinal canal. Herren and Edwards[1] noted the coexistence of spina bifida or spina bifida occulta in about half of the cases. These authors reviewed the literature and collected 42 cases, to which they added one of their own. Pickles[2] and Neuhauser, Wittenberg and Dehlinger[3] have subsequently reviewed the literature and added cases of their own. To these we wish to add the following case.

### REPORT OF CASE

S. S. is a 4-year-old girl whose mother brought her for medical consultation on April 25, 1951. The mother stated that since the child's birth there had been a large mane of dark brown hair hanging from her back. The child developed normally and learned to walk at the age of 1. Six months prior to consultation the child began to complain of pain in the back, which was persistent but did not radiate. The mother stated that at the same time the child began to complain of pain, her gait showed a change to a clumsy waddling walk.

The remainder of the general and neurologic history was noncontributory. General physical examination showed the child to be entirely normal as to growth and development, except for the presence of a heavy growth of hair (Fig. 1) arising in the back, in the region of the lower thoracic and the upper lumbar area. The hair could be combed out to hang as far down as the patient's gluteal folds. Neurologically the child was normal except for a gait midway between a waddle and a spastic type of movement of the legs. Bilaterally the quadriceps femoris reflexes were markedly increased, as were the Achilles reflexes. There was a bilateral Babinski reflex. Sensory examination, so far as could be determined in a child 4 years old, revealed no abnormalities. The anal sphincter reflex was normal. The results of laboratory studies were within normal limits. The protein content of the spinal fluid was 18 mg. per hundred cubic centimeters. Roentgenograms of the spine were taken, and Dr. Morton reported them as showing a spina bifida defect of the twelfth thoracic segment, with supernumerary ossification centers involving the first and second lumbar vertebrae, producing widening of the bodies. The pedicle shadows were spread apart, but were normally rounded and showed no erosion or flattening (Fig. 2).

A pantopaque myelogram was then taken, which showed the pantopaque column splitting into two columns at the upper edge of the second lumbar body (Fig. 3) and reuniting into a single column at the level of the eleventh thoracic vertebrae. The outlined oval appeared to have a central osseous mass or spicule arising from the upper part of the first lumbar body. The diagnosis of diastematomyelia was made, and operation was performed on April

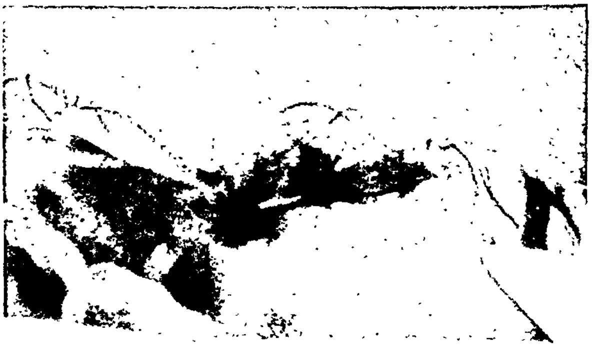

Fig. 1.—Hairy malformation in lumbothoracic area of patient with diastematomyelia.

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30. An incision was made from the level of the eleventh thoracic spinous process to that of the second lumbar spinous process, and the muscles were reflected bilaterally from the spinous processes and the respective laminae. A bilateral laminectomy was begun at the level of the second lumbar lamina and was extended upward. At the first lumbar level, no spinous process was found, and the laminae were united in the midline by a fibrocartelagenous bridge. As the laminectomy was continued at the first lumbar level, a midline osseous spur was observed, arising from the fibrocartilaginous band and extending through the dura to the body of the first lumbar vertebra. The dura was divided at this level into two complete sacs, which united into a common sac at the level of the eleventh thoracic vertebra. The cauda equina was divided.

A division of the lower sacral segements of the cord could not be detected. The bony portion was rongeured away, and its wide base of orgin on the first lumbar body was waxed in an effort to prevent possible regeneration of the septum. The operation was ended with the usual closure. The pathologic report on the specimen was that of a small osteoma showing no evidence of malignancy. The patient's postoperative course was uneventful, and she was discharged home on the tenth postoperative day. Examination on final discharge, three weeks after the operation, showed a return of growth of the large mane of hair, normal quadriceps and achilles reflexes, and no evidence of a Babinski reflex in either foot. The gait was considered normal.

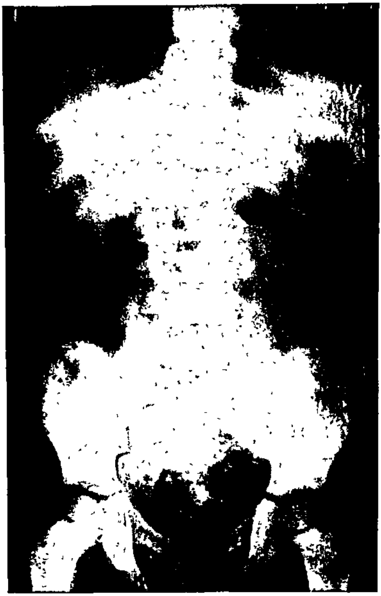

Fig. 2.—Anterior posterior roentgenogram of spine, showing a centrally placed bony spur at the level of the first lumbar vertebra, with widening of the spinal canal.

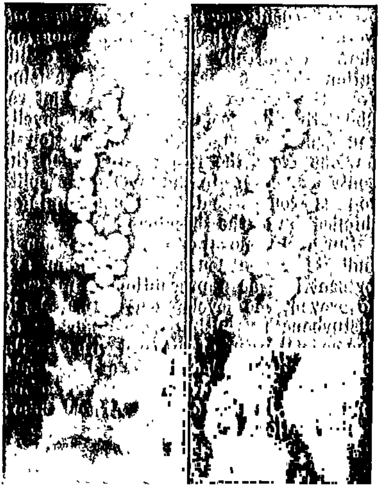

Fig. 3.—Myelogram showing the Pantopaque column splitting into two columns at upper edge of second lumbar vertebral body and reuniting at the level of the eleventh thoracic vertebra.

COMMENT

One may suspect the presence of diastematomyelia, a rare congenital malformation, by the presence of the hairy growth over the spine. It is well to realize, however, that a hairy growth in the vertebral area is not always associated with this defect, for in our last 4 cases, in which an equally dramatic [illegible] present, roentgenograms and myelograms were normal. When the roentgenogram shows a centrally placed area of ossification that appears as a spur arising from the body of a vertebra in the lateral films, the diagnosis of diastematomyelia can generally be made. Confirmation is obvious from the manner in which the contrast medium in the myelogram splits to pass around the defect, thus outlining a duplication of the thecal canal.

Surgical removal of the bony septum is indicated when neurologic symptoms are present and as a precautionary measure to prevent the development of neurologic disturbances resulting from hindrance of the normal ascent of the cord with growth. Such a centrally placed spur of bone could easily anchor the cord or the cauda equina, and result in the so-called Arnold-Chiari malformation.

## CONCLUSION

A case of diastematomyelia is reported with roentgenograms showing the central defect and a myelogram showing duplication of the thecal canal. Laminectomy was performed, with removal of the bony septum, and was followed by relief of symptoms.

## RÉSUMÉ

L'auteur présente un cas de diastématomyélie, avec un radiogramme montrant l'affection centrale et un myélogramme révélant un double canal thecal. On pratiqua une laminectomie avec ablation du septum osseux. Cette intervention fut suivie de régression des symptômes.

## ZUSAMMENFASSUNG

Es wird ein Fall von Diastematomyelie vorgestellt. Die Röntgenaufnahmen zeigen den zentralen Defekt, und ein Myelogramm lässt die Verdoppelung des Durakanals erkennen. Es wurde eine Laminektomie mit Entfernung des knöchernen Septums ausgeführt. Danach verschwanden die Symptome.

## RESUMEN

Se comunica un caso de diastematomielia con roentgenogramas mostrando el defecto central y un mielograma mostrando la duplicación del conducto tecal. Se realizó laminectomía con extirpación del septum óseo. Se obtuvo el alivio sintomático.

## RIASSUNTO

Viene descritto un caso di diastematomielia, documentato da radiogrammi e da mielogrammi. Fu eseguita una laminectomia che consentì di asportare il setto osseo. Ne seguì la guarigione.

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* * *

Pay no attention to what critics say. There has never been set up a statue in honor of a critic.

—*Sibelius*

# *Editorial*

## Section on Neurosurgery
## A New Field of Cooperative Endeavor

IN this issue of the Journal we present, with great pleasure and satisfaction, the presentations, discussions and scientific aspects of the initial meeting of the Neurosurgical Section inaugurated at the Eighteenth Annual Congress of the United States and Canadian Sections of the International College of Surgeons in New York on Sept. 13, 1953. We feel that this new Section, in addition to meeting an urgent contemporary need, will become a valuable link in the coordination of neurosurgery with specialization in many allied fields. Every such cooperative effort, when sincerely conceived, efficiently planned and carried out in accordance with the ideals that originally led to its establishment, must reduce the undeniable dangers that lie in overspecialization and at the same time provide all surgeons with a central source of the information they need in correlating their own work with that of the profession in general. The International College of Surgeons is a many-branched organization, but it is an integrated one; and, as constant advances in research, discovery and technic place upon us all the obligation of acquiring as much knowledge and understanding as possible, we recognize the equal obligation of sharing both with our colleagues.

The first meeting of the Neurosurgical Section more than fulfilled our hopes and expectations. A full day's program was devoted to the spine and spinal column, beginning with studies on the physiologic mechanisms of spinal shock, spinal cord reflexes and regeneration of the cord and proceeding, later in the morning session, to surgical treatment of congenital spinal disorders and spinal cord tumors and cysts. The afternoon was given over largely to the management of injuries to the cervical portion of the spine, disturbances of the bladder from the neurologic point of view and the spasticity of paraplegia. The speakers and discussants were eminent men, authorities in their particular fields. As was fitting for an international group, several came to us from other countries, including Hawaii, Turkey and Sweden. Dr. Harold C. Voris of Chicago, who introduced the newly organized Section at the afternoon session, made the following remarks:

"This is the Neurosurgical Section of the International College of Surgeons in the United States and Canada, at whose Eighteenth Annual Congress we are now assembled. Quite a formidable title! But it must be pointed out that, since no part of the College excludes or is excluded from the others, and the Neurosurgical Section is an integral part of the international group, we find it highly gratifying to have had Dr. Hagbarth of Sweden on our morning program and now have the privilege of introducing Dr. Feyyez Berkay, Assistant Professor of Surgery and Neurosurgery at the University of Istanbul, who is a Fellow of this organization and of the American College of Surgeons and is certified by the American Board of Surgery."

Both Dr. Hagbarth and Dr. Berkay made valuable and significant contributions to the program, as did the distinguished American surgeons who participated. A panel discussion on the surgical treatment of the intervertebral disc from two points of view, that of the neurosurgeon and that of the orthopedic surgeon, was both excellent and stimulating. At the forthcoming Nineteenth Annual Congress in Chicago in September, the idea will be carried on with a panel discussion of the painful neck, shoulder and arm.

The symposium type of program is admirably suited to our purpose, serving as it does the College ideal of organization for the study and correlation of knowledge and instruction in surgery and the sciences allied thereto. At the Nineteenth Congress our subject of discussion will be cancer of the brain. Not only primary and metastatic carcinoma but malignant glioma will be considered. There will be papers on angiography and the surgical management, as well as on the cyclotron and on radioactive isotopes and other chemical substances. The discussions will occupy a place on the program of an importance equal to that of the original presentations.

This brief account of the founding, first meeting and proposed activities of the Nurosurgical Section would be incomplete without an expression of thanks from myself as Chairman, Dr. Voris as Co-Chairman and Dr. Kenneth H. Abbott, Secretary, on behalf of the neurosurgical members of the College, to Dr. Max Thorek, Founder and Secretary General of the International College and Editor of the Journal, for his support in forming the new Section and his cooperation in publishing this special issue. With the Section as a rallying point, we believe that more neurosurgeons will wish to participate in our future programs. They will be cordially welcomed. We wish also to thank once more the authors and discussants who made our first Section meeting so memorable and revivifying an experience.

JAMES WINSTON WATTS, M.D.,
F.A.C.S., F.I.C.S., Chairman

◆

Vesalius may be rightly described as the Father of the Renaissance in medicine, and his work was followed by William Harvey's discovery of the circulation of the blood. This knowledge is now the property of every schoolboy, but it is only three hundred years old, and it is interesting to reflect that this bit of information, which a lad of ten recognizes as a fundamental part of life, was not known to the great thinkers of the ages, including Plato, Aristotle, Cicero, Thomas Aquinas, St. Augustine, or the Apostle Paul. Vesalius and Harvey were followed by a host of anatomists who spent the next fifty years showing, among other things, how many mistakes in anatomy old Galen and his followers had taught for more than a thousand years.

—*Major*

# New Books

**Neurosurgery of Infancy and Childhood.** By Franc D. Ingraham and Donald D. Matson. Springfield, Ill.: Charles C Thomas, Publisher, 1954.

Children are not miniature adults. A number of general surgeons who have had the opportunity of working in large children's hospitals have recognized this and have so perfected themselves in the surgical problems of childhood that they can be considered pediatric surgeons. However, the neurosurgical problems of children, like those of adult life, require a basic knowledge of the form, functions and disorders of the nervous system if they are to be properly dealt with. The authors of this book are well-known surgeons who have had extensive experience in adult neurosurgery. This book is based on their wide experience with neurosurgical problems in children at the Children's Medical Center in Boston. The extent of this experience is indicated by their treatment of over 1,400 children with spina bifida, and their series of 313 histologically verified intracranial tumors in children under 12 years of age, their 63 cases of intraspinal tumor in the same age group.

Other authors have taken up specific neurosurgical problems of childhood in books or monographs, especially the intracranial tumors, and a general survey of pediatric neurosurgery has been briefly attempted in a few articles. This is the first textbook of pediatric neurosurgery. It includes congenital anomalies of the central nervous system and its coverings; hydrocephalus; trauma; intracranial tumors; intraspinal tumors; infection; cerebral vascular disorders; epilepsy; encephalopathy, and finally pediatric neurosurgical anesthesia. The sections on congenital anomalies and hydrocephalus are the most original and represent the very important personal experience of the authors in this field.

The book is well illustrated with 380 illustrations and 1 plate, and the bibliography includes 206 references. Every neurologic surgeon and everyone concerned in the care of children should read this book and have it available for reference.

HAROLD C. VORIS, M.D.

**Clinical Orthopaedics.** Edited by Anthony F. DePalma. Philadelphia: J. B. Lippincott Company, 1954.

This is the third volume of a new series entitled *Clinical Orthopaedics*. It consists of 23 original articles written by well-known orthopedic surgeons and assembled by Anthony F. DePalma, the Editor-in-Chief of the series. This third number is divided into two sections. Section 1 consists of articles describing injuries or diseases of the soft tissue about joints and the methods of treating these conditions. A partial list of the subjects includes injuries to ligaments of the knee or ankle, cysts of and injuries to the semilunar cartilages of the knee, dislocations of the patella, and injuries to the rotator cuff of the shoulder. Section 2 includes articles of a more general type. A paper on giant cell tumors is particularly noteworthy. The first two volumes of *Clinical Orthopaedics* were accepted by the medical profession with considerable enthusiasm. This third volume have equal value for the orthopedic surgeon, as well as for all surgeons who are called upon to treat injuries to the spine and extremities.

EDWARD L. COMPERE, M.D.

**The Chest. A Handbook of Roentgen Diagnosis.** By Leo G. Rigler. Chicago: The Year Book Publishers, Inc., 1954. 2d ed. Pp. 380, with 338 illustrations.

It is surprising what a wealth of diagnostic material has been included in this small, very useful reference volume. The illustrations are excellent, well chosen and handy to the pertinent material in the text. Included are details of the examination technic and bases for interpretation of the roentgenograms. Stress is laid upon the clinical aspects of the work of the radiologist. The material from which the illustrations have been selected is well known for its extent and diversity. In his radiologic work the author exemplifies the ideal roentgen diagnostician and sets a high standard of proficiency for all who study his teachings.

[illegible] JAMES T. [illegible]

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---

CONTENTS—AUGUST, 1954

---

A Cardiopulmonary Machine for Extracorporeal Circulation of Blood.................. 107
*Achille Mario Dogliotti, M.D., F.I.C.S., Giorgio del Poli, and Leonardo Caldarola, Turin, Italy*

Complete Extrathoracic Esophagoplasty.................................................. 115
*E. von Novak, M.D., F.I.C.S., Dacca, Pakistan*

Impending Death Under Anesthesia.....................................................
*Max Thorek, M.D., F.I.C.S., Chicago, Illinois*

Varying Relations of the Common Bile Duct with the Posterior Face of the Pancreatic Head in Negroes and White Persons ........ 150
*Trieste Smanio, M.D., F.I.C.S., São Paulo, Brazil*

Intestinal Suturing and Plication ........ 174
*Thomas B. Noble, M.D., F.I.C.S., Indianapolis, Indiana*

The Plastic Flap in Closure of the Pilonidal Cyst Excision Defect ........ 181
*Thomas J. Lalor, M.D., A.I.C.S., Woonsocket, Rhode Island*

Status of Extrapleural Pneumothorax: Clinical Analysis of 150 Cases of Pulmonary Tuberculosis ........ 190
*Sacid Tezelli, M.D., F.I.C.S., Istanbul, Turkey*

Rehabilitation of Patients with Spastic Paralysis ........ 200
*Temple Fay, M.D., F.A.C.S., F.I.C.S., Philadelphia, Pennsylvania*

Subacute Disseminated Lupus Erythematosus and Uneventful Pregnancy ........ 204
*E. M. Kammerling, M.D., and S. J. Turner, M. D., F.A.C.S., F.I.C.S.,*
*Chicago, Illinois*

The Importance of Cervical Lacerations in the Management of Habitual Abortions ........ 208
*Werner Steinberg, M.D., F.I.C.S., Linden, New Jersey*

An Improvised Frame for Temporary Splinting in the Treatment of Congenital Dislocation of the Hip ........ 211
*Max Scheck, M.D., A.I.C.S., San Francisco, California*

SECTION ON OPHTHALMOLOGY AND OTORHINOLARYNGOLOGY

Acoustic Trauma: A Clinical and Laboratory Study ........ 214
*H. G. Kobrak, M.D., Ph.D., Chicago, Illinois*

EDITORIAL

The Use of the Cobalt 60 Unit ........ 219
*T. A. Watson, M.B., Ch.B., D.M.R., Saskatoon, Saskatchewan, Canada*

NEW BOOKS ........ 223

ABSTRACTS FROM CURRENT LITERATURE ........ 225

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# *Original Articles*

## A Cardiopulmonary Machine for Extracorporal Circulation of Blood

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GIORGIO DEL POLI[†] AND LEONARDO CALDAROLA[§]
TURIN, ITALY

A NUMBER of eminent physicians (Haken, Ellis, Nordmann, Bailey and O'Neill) have mentioned the need of improving cardiosurgical technic by devising some form of extracorporal circulation capable of diverting the blood stream away from the field of operation. At our school, which has a Cardiosurgical Center, great interest was shown in an artificial heart-lung and great desire for its acquisition, in order to keep pace with what was being accomplished abroad and planned in Italy.

In the planning and construction of our type of machine (see illustration), the late Prof. Constantini as well as ourselves, Rironti, and Bassé took part. In the beginning it was desired to construct an apparatus suitable for providing a bloodless heart, even if only for a short period. On the advice of one of us, (Prof. Dogliotti), however, consideration was also given to achieving partial extracorporal circulation, which would enable us to avoid the damage associated with total extracorporal circulation and would also provide a well-grounded means of reanimation capable of bringing the functions of heart and lung to the physiologic level at a time of crisis.

The most important aspects of the construction are oxygenation and the decrease of carbon dioxide, processes that may be referred to as *arterialization*. Our endeavors to reach a satisfactory solution of the problem were unanimous; in fact, the proposed variations and biologic controls were chiefly concerned with artificial

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[*] Summarized form of material previously published (Minerva Med. 1:—, 1944).
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hematosis. We wished to obviate the damage of oxygenation devices by inverting, so to speak, the usual respective volumes of the two substances in contact, i. e., oxygen and blood. This meant driving the therapeutic oxygen into a blood stream of thick stratum, instead of reducing the blood to a thin stratum in an oxygenated atmosphere.

Our apparatus for oxygenation of the blood and maintaining the physiologic hydrogen ion potential is constructed as follows (see illustration, *2*): A large candle of porous porcelain, similar in structure to the candles used in bacteriologic work, is covered by a glass sheath. Between candle and sheath there is an empty space 3 mm. wide, which serves as a chamber of oxygenation. The system is placed vertically; the blood flows into the empty space from above while the oxygen is introduced from below and disperses in a micro-bubble mist. In this way the formation of froth is almost eliminated.

In several tests, saturation of the blood with oxygen reached 95 to 96 per cent. This is higher than the level considered necessary to provide a margin of safety by most other authors (80 to 90 per cent).

Our apparatus for total or partial extracorporeal circulation, is supplied with two systems for oxygenation which can work singly, together, or in series, according to necessity. In the glass container there are a tube, a tank and a safety glass bubble; the blood, coming from the oxygenating chamber, undergoes a regulated depression sufficient for the partial elimination of carbon dioxide.

The machine is furnished with a group of pumps (see illustration, *3*) driven by electric motors, of pipes which carry out the mechanical functions of aspirating the blood from the venous system, bringing it to pressure, and injecting it into the arterial system. For the propulsion of the blood we have rejected pumps with valves, because they would form fibrin and cause destruction of morphologic elements; and we have adopted, as a suitable mechanical device, the rotating type of pump in which an elastic tube becomes circularly compressed in such a way as to insure a continuous blood stream. To eliminate to the utmost possible extent the contact of the blood with the mechanical device, which causes hemolysis, destruction of elements of the white series and platelets, and formation of fibrin, all our material is coated with silicon varnish, which makes surfaces hydrorepellent (*4*).

To guarantee the absence of clots, a metallic filter is put at the pipe outlet of the machine; moreover, the cannula of plastic material which is introduced into the patient's venous system is supplied with a heparin dropper (*5*).

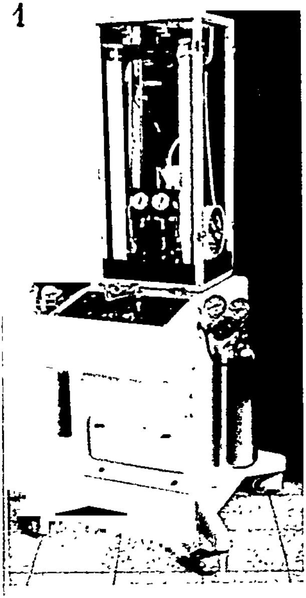
The upper part of the apparatus, which contains the means for the flow and collection of the blood, can be easily and quickly sterilized in an autoclave (*6*); in the course of artificial circulation it works like a normal thermostat.

There is also a set of devices to treat the blood in extracorporal circuit either with ultraviolet irradiation or with physiologic or medicinal liquids.

Section 7 of the illustration shows an instance of extracorporal circulation performed with our apparatus. On the right the drawing shows the corporal circulation. In one of the veins connected with the upper vena cava, a tube is introduced for aspirating the blood, which is returned arterialized, in a common carotid. From the sinus of the caval veins the blood is aspirated by the first pump. Brought into the oxygenation chamber, it flows from the top vertically and is enriched by the oxygen given out by the porcelain candle in the form of a micro-bubble mist. Through a large tube, the blood is collected in a

Group of photographs (opposite) illustrating equipment and technic. *1*, cardiopulmonary machine; *2*, apparatus for oxygenation of blood and maintenance of normal hydrogen ion potential; *3*, pumping apparatus; *4*, surfaces treated with silicon varnish to make them hydrorepellent; *5*, heparin dropper; *6*, upper portion of apparatus, which contains the means of flow and collection of blood; *7*, technical schema of extracorporal circulation as obtained with machine described. See text for fuller explanation.

1



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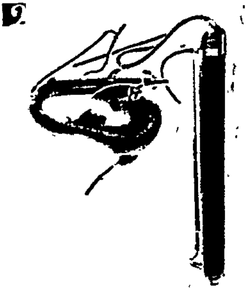

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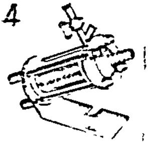

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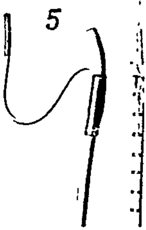

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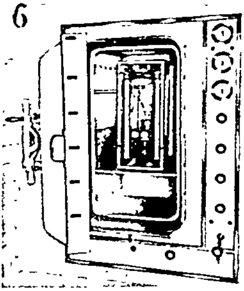

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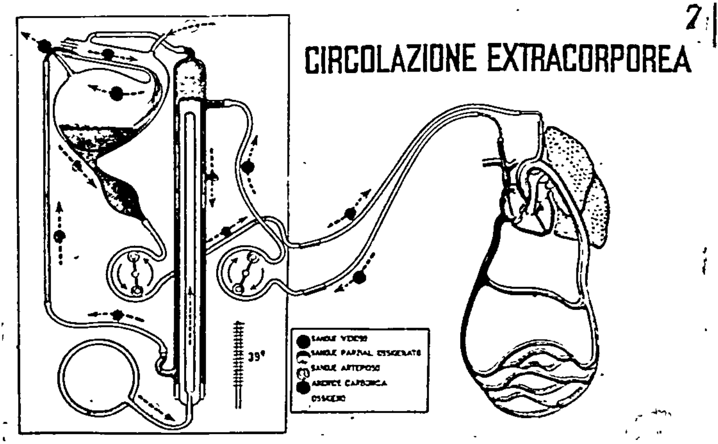
CIRCOLAZIONE EXTRACORPOREA
39°
● SANGUE VENOSO
SANGUE PARZIAL. OSSIGENATO
SANGUE ARTERIOSO
● ANIDRIDE CARBONICA
OSSIGENO

tank in which a depression is made; this has the function of favoring both the elimination of carbon-dioxide and the surface stratification of the froth, which usually forms in negligible quantity.

From the tank, which is equipped with a safety device (glass bubble) by means of a second pump, also of the rotating type, the blood is aspirated, and through another pipe it is carried to the common carotid.

Our researches on extracorporal circulation were undertaken through varied experiments, with trials of the different kinds of operating technics proposed to establish a circuit excluding heart and lung. In a first group of animals, after a right thoracotomy had been done, aspiration of the venous blood was carried out with two cannulas introduced respectively in the upper vena cava through the azygos and in the lower vena cava through the right auricle.

With this experimental device, adopted by Gibbon and afterward by other authors, the whole mass of venous blood (with the exception of that of the coronary circulation, which almost totally reflows in the atrium dextrum) is conveyed to the apparatus.

The quantity of blood that circulates through the coronary system may be rated at about 66 cc. per minute and per 100 Gm. of cardiomuscular tissue. This rather large quantity, which is excluded from the extracorporal circulation, passes into the pulmonary artery and into the lungs, where it can be oxygenated.

Ligation of the pulmonary artery cannot be undertaken, because it causes swelling of the right side of the heart and in a short while causes the organ to stop. Therefore it cannot be stated that, in these experimental phases, "total" extrapulmonary circulation has been achieved. Exclusion of function, however, can be obtained, independently from the way in which blood is drawn, by preventing the animal from breathing by occlusion of the trachea or by covering its muzzle hermetically.

It should be stated that, in these conditions, animals which have not been treated with artificial circulation die, without exception, in periods ranging from three to four minutes.

In a second group of experiments, aspiration of the blood was accomplished in a simpler manner by means of a cannula introduced through the auricle into the atrium dextrum, and the function of the lungs was excluded by ligation of the pulmonary artery.

In a third experimental group, also to avoid the trauma of the thoracotomy and the danger of hemothorax (which sometimes occurs notwithstanding careful hemostasis and the use of protamine sulfate) a plastic cannula marked in centimeters was introduced into the jugular vein, externally at the right (in dogs this vein is much larger than the internal jugular vein) or in the common right iliac vein. The cannula was then made to slide up to reach the atrium dextrum, and the function of the lungs was excluded by obstructing the respiratory tracts.

The return of the arterialized blood to the animal was done in every case by means of a cannula introduced into the cardiac end of a common carotid. Artificial circulation was protracted in different animals for periods varying from fifteen to forty-five minutes.

The quantity of blood made to circulate through the apparatus ranged from 700 to 1,400 cc. per minute, according to the weight of the dog under experiment (10 to 15 Kg.). A partial circulation with a 200 to 300 cc. flow, with the lungs permitted to function, was maintained in several experiments for a long time (up to two hours) without evoking any particular signs of suffering in the animal.

In the animals that underwent thoracotomy the course of the experiment was followed and controlled also with the heart in full sight. It continued to beat vigorously and rhythmically. The electrocardiogram, taken in some cases, showed no pathologic signs worthy of note. In none of the surviving animals, after the experiment and also after a lapse of time, was any deficiency noted which could be attributed to lesions of the central nervous system.

In order to be sure that passing through the apparatus would neither cause alterations of the blood in such measure as to turn it toxic, nor produce serious modifications in its morphologic composition, many tests were carried out *in vitro* and *in vivo*, as well as on biologic controls, all with highly satisfactory results.

Further application of our apparatus has enabled us to gather other interesting data. Performing our experiments with the artificial heart-lung apparatus on dogs, we obtained first-hand results concerning accidents that are often encountered in practice—electrocution, drowning, poisoning from carbonoxide—thus widening the field of surgical reanimation.

On electrocution we carried out experiments by using a single phase (A.C.) of 50 periods and a tension of 200 volts; with a self-transformer we varied the tension from 60 to 220 volts and, by means of a switch with delayed controllable trip gear, charged the animals with electricity for different lengths of time, ranging from one-fifth to five seconds. The two electrodes were placed on shaved skin, respectively on the left foreleg and the right hindleg. The kymograph registrated the femoral arterial pressure and the breathing.

In those cases in which extracorporal circulation was employed, we introduced the cannula for aspiration of the venous blood through the superficial jugular vein up to the atrium dextrum. The two cannulas distributing the arterialized blood were introduced into the common carotid, one cephalad and the other, of greater dimensions, in the direction of the heart.

In a group of animals charged with electricity of reduced potential (100 volts) for a relatively prolonged period (four seconds), we obtained revivification by means of extracorporal circulation, while the control animals, which had undergone the same electrical trauma and had been treated simply with the usual means of reanimation, all died.

In a group of animals given a powerful electric discharge (220 volts) for even a very short time (one-fifth to one second) the use of the heart-lung apparatus proved ineffective. In all these animals, either with the heart in full sight or on electrocardiographic examination, immediate ventricular fibrillation was observed.

In cases of experimental drowning in which the heart-lung apparatus was used, a high percentage of animals returned to life. In those cases in which extracorporal circulation was not employed the animals died, notwithstanding the use of the usual therapeutic procedures.

The electrocardiographic study of the animals that eventually died showed the setting in of ventricular fibrillation, which confirmed the failure of our apparatus in these instances.

The experiments successfully carried out suggest, in our opinion, the following considerations: When the reserve energies of the heart are exhausted, owing to rapid anoxemia, stasis in the right side of the heart or pulmonary insufficiency, employment of the artificial heart-lung, which adjusts these extremely threatening conditions enables one to overcome all danger. Tasks most assuredly fulfilled by the cardiopulmonary machine are those of discharging the right side of the heart, abnormally engaged by the pulmonary barrier and by hypertension from drowning, and of putting into the arterial circulation richly oxygenated blood, so as to prevent prelethal tissue asphyxia of the heart as well as of the cerebral and bulbar centers.

As to acute poisoning from carbon dioxide, in each test two animals were poisoned by illuminating gas, and one of them was used for a control. They were placed in a cowl for chemical researches. hermetically sealed, but were [illegible] with a kymograph [illegible] sure at the f [illegible] treated with he [illegible] fore the experiment took place. One of them was connected with the cardiopulmonary machine, the superficial jugular vein and the common carotid having been prepared. During the experiment, the part of our oxygenator set out for guiding the blood flow and for the partial elimination of carbon dioxide, purposely made of quartz, was irradiated with a flood of ultraviolet rays in exploitation of important photochemical effects described by Haldane. In a first series of experiments the poisoning by illuminating gas was not pursued to the point of death. In these cases the extracorporal circulation, strengthened by ultraviolet irradiations, proved effectual.

In a second series of animals the poisoning was carried out until all vital manifestations disappeared. In these cases, notwithstanding the prolonged use of the cardiopulmonary machine (more than half an hour) with maximum oxygenation and ultraviolet irradiation of the blood, we achieved the reanimation of 1 animal only. All the controls died. These results, even if not wholly satisfactory, are not, in our opinion, to be put aside. We are confident that with improved experimental methods, especially in reference to the possibility of releasing a greater quantity of carbon dioxide from the blood by greater depression, better results can be hoped for.

We shall report here, as examples, some cases in which our cardiopulmonary machine had been applied to man.

On Aug. 7, 1951, for the first time, emergency extracorporal circulation was employed. The patient had a large malignant tumor of the mediastinum, which pressed severely on the venae cavae and the right side of the heart.

Removal of the tumor showed it to be particularly hemorrhagic, and, during the phase of isolation the compression on the heart and the mediastinal vessels increased, thus creating immediate danger that the patient would die of arrest of the heart and asphyxia. We then applied our apparatus, which had been prepared beforehand. The cannula for aspiration of venous blood was driven into the upper vena cava, up to the atrium dextrum, passing through the right axillary vein, while the cannula for injecting the oxygenated blood was introduced in the brachial artery.

As soon as the artificial circulation began, there was a rapid and lasting rise of the arterial pressure, with quick resolution of the stasis and disappearance of cyanosis. It was then possible, without further accidents, to remove a great part of the pathologic mass. There followed an uneventful postoperative period, without any evidence of damages attributable to the use of the apparatus, and the patient survived for a year after the operation.

A second case was that of a patient with an esophageal neoplasm and a jejunal fistula, which had formed a month before. Owing to the extent of the esophageal lesion and the probable presence of pulmonary metastasis, together with the general poor condition of the patient (especially from the cardiopulmonary point of view), radical surgical intervention appeared to be impossible. We then decided to establish partial extracorporal circulation to obviate the precarious condition of the right side of the heart and hematosis.

The apparatus had previously been filled with fresh uncoagulable blood recently collected (1,000 cc.) and two cannulas were placed, one at the brachial artery and one at the basilic vein, as in the former case. Heparin solution, regulated by a dropper (2 mg. per hundred cc. of blood) was driven by special appliance into the vein. The increase of coagulation time was finally adjusted by injecting a quantity of protamine sulfate equal in weight to the heparin.

The machine was able to provide a blood flow of more than 500 cc. per minute. The cardiologist who cooperated with us went on registering the cardiocirculatory condition of the patient all through the experiment, suggesting the steps for regulating the aspiration of the venous blood.

The information given us by the specialist was satisfactory. The extracorporal circulation over, suture of the arterial wound was performed.

On that day and on the following days, diuresis was regular; no trace of pathologic elements, including erythrocytes or hemoglobin, was observed in the urine. Comparison with the electrocardiographic diagrams taken before, during and after the assisted circulation clearly showed an improvement in myocardial vascularization. Even the humeral arterial pressure, especially the differential one, and the pulse beat, were improved after the use of the cardiopulmonary machine.

The first case of mitral stenosis in which operation was performed in an "open field" and with a bloodless heart occurred last year.*

By administering some antihistaminic drug, whose hypnotic properties are known, and a ganglion-blocker (metonium salts), rapid perfrigeration was obtained; then a left anterolateral thoracotomy was performed at the third intercostal space. When the pericardium was opened, mitral stenosis of high degree was discovered by *introducing a fingertip through the left* auricle; the cardiopulmonary machine was inserted by placing a cannula into the axillary vein up to the upper vena cava and another into the brachial artery.

After a check as to the efficiency of the machine, the pulmonary artery was isolated at its origin and closed with a special clamp. At this point the apparatus for artificial circulation was started, at the rate of 500 cc. blood aspiration per minute, with the purpose of avoiding hypertension of the right side of the heart. At the same *time the atrium sinistrum was opened and* found practically empty; the anterior commissurotomy was performed with full vision, and after two minutes and fifty seconds, the heart was closed. We avoided, by continual rinsing with physiological solution of sodium chloride, the danger of gas embolism; then, with our apparatus, an endo-arterial transfusion was started with the same blood previously aspirated, which, having undergone abundant oxygenation, had become arterialized. The cardiac operation accomplished, the patient was gradually warmed. The postoperative period was satisfactory.

The results we have obtained with extracorporal circulation, with a trend clearly cardiosurgical, stimulate us to proceed along this line with a certain optimism.

In many pathologic circumstances (acute pulmonary edema, asphyxial syndromes of various types, acute cardiac insufficiency, etc.) it is possible, in our opinion, to obtain favorable results by this means. We are convinced also that it can be usefully adopted during major surgical operations, especially on the heart and brain, and also can be associated with controlled hypothermia. It is a question of new fields, practically unexplored as yet, and it is very difficult to foresee to what extent their achievement will be established. But the aims are so suggestive, and of such an importance, that we hope many other scientists will help us in our efforts to *shorten the way and reach more gratifying* results.

### ZUSAMMENFASSUNG

Der Verfasser beschreibt einen zur Zeit am Universitätsinstitut für Klinische Chirurgie in Turin (Italien) angewandten Herzlungenapparat, der zu Erzeugung der Blutzirkulation ausserhalb des Organismus dient. Erfolgreich ausgeführte Versuche lassen die Anwendbarkeit des Apparates bei Erschöpfung der Kraftreserve des Herzens erkennen, die durch plötzlichen Sauerstoffmangel, Stauung im rechten Herzen, Erstikkungszustände, akutes *Lungenödem usw. zustande kommt.*

### RESUMEN

El autor describe una maquina cardio-*pulmonar para circulación extracorpórea,* actualmente usada en el Instituto Universitario de Clínica Quirúrgica en T
Italia. Los ex
con éxito sugie
en condiciones

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*Dogliotti-Ciocatto: Bulletin of the Soc. Piemontese di *Chirurgia, Vol. XXIII n° 6, 1953.*

de la reserva energética miocárdica debido a la anoxemia rápida, estasis del corazón derecho, síndromes asfícticos, edema pulmonar agudo, etc.

### SUMARIO

O autor descreve uma máquina cardiopulmonar para a circulação extracorporal, atualmente usada na Universidade do Instituto de Cirurgia Clínica em Turim, Itália. Experimentações realizadas com sucesso surgerem a utilidade do aparelho sob condições que incluem exaustão da reserva de energia do coração devido a anoxemia rápida, estase no lado direito do coração, síndromes asfixiais, edema pulmonar agudo, etc.

### RIASSUNTO

Viene descritta una macchina cardiopolmonare per la circolazione extracorporea, che è in uso nella Clinica Chirurgica di Torino (Italia). E' stata impiegata con successo in casi di insufficienza cardiaca da anossiemia, da stasi del cuore destro, da sindrome asfittica, da edema polmonare acuto, ecc.

◆ ◆

The pursuit of philosophy is founded on the belief that knowledge is good, even if what is known is painful. A man imbued with the philosophic spirit, whether a professional philosopher or not, will wish his beliefs to be as true as he can make them, and will, in equal measure, love to know, and hate to be in error. This principle has a wider scope than may be apparent at first sight. Our beliefs spring from a great variety of causes: what we were told in youth by parents and schoolteachers, what powerful organizations tell us in order to make us act as they wish, what either embodies or allays our fears, what ministers to our self-esteem, and so on. Any one of these causes may happen to lead us to true beliefs, but is more likely to lead us in the opposite direction. Intellectual sobriety, therefore, will lead us to scrutinize our beliefs closely, with a view to discovering which of them there is any reason to believe true. If we are wise, we shall apply solvent criticism especially to the beliefs that we find it most painful to doubt, and to those most likely to involve us in violent conflict with men who hold opposite but equally groundless beliefs. If this attitude could become common, the gain in diminishing the acerbity of disputes would be incalculable.

—*Russell*

# Complete Extrathoracic Esophagoplasty

E. VON NOVAK, M.D., F.I.C.S.*

*DACCA, PAKISTAN*

As long as twenty years back, my co-workers and I became much interested in establishing a routine, safe method to form an extrathoracic esophagus. The horizon in this particular field was then rather gloomy. There have been brilliant successes all over the world; nevertheless, the scarcity of patients in need of that operation, their low resistance and the overcomplicated methods in current use made it a rather risky operation.

I fully agree with Grey Turner's statement that the mortality rate has been not less than 35 per cent and that not more than 50 per cent of the patients on whom operation has been begun have carried through to a successful conclusion.

Some twenty years ago, in Hungary, the esophagoplasty had great practical importance. Each country and each era has a favorite method used by persons who wish to commit suicide. In Hungary the cheap, strong, alkaline solutions used for household purposes were sold freely; hence, they were widely used for suicide. Strong acid solutions being difficult to get, none of my patients have been poisoned by them. Moreover, in the households of the poorer classes, the strong alkaline solutions frequently lay on the shelf in a ordinary bottle, so that small children had free access to them. It cost us many years of hard work to persuade the Parilament to ban the free selling of these dangerous solutions. Meanwhile all the large hospitals have been forced to establish special departments for the treatment of the unfortunate victims.

With prohibition of the free distribution of strong alkaline solutions the incidence of poisoning dropped sharply. Cases became rare. The question could have been put forward, has esophagoplasty in its complete form any longer any great practical interest? The answer must be a definite "Yes." In the past twenty years thoracic surgery has developed very rapidly, and modern anesthesia made it possible to operate on the esophagus through the thorax. Improved diagnostic methods brought more and more operable malignant tumors of the esophagus to the surgeon.

In the light of latest experiences with malignant tumor of the thoracic portion of the esophagus, it is best treated by removal of the whole of this part. One should not be content with partial removal. Submucous spread many inches above the tumor is always possible, and malignant cells may be already there when nothing can be seen by esophagoscopic or roentgen examination.

Removal of the thoracic portion of the esophagus opens two possibilities for making a connection between the cervical part of the gullet and the stomach. One is to mobilize the stomach and pull it high to make the connection with the oral stump of the esophagus. The second, in my opinion the safer proceeding, is to finish the first act by removal; to close the aboral stump and bring out the cervical portion of the esophagus above the clavicle and proceed with a complete extrathoracic esophagoplasty later.

It is possible to make a connection with some type of rubber or plastic tube between the cervical portion of the esophagus and the gastrostomy opening. Such a solution, however, would not be tole
for any length of time, since the pa
could not be fully soci
stances.

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*Professor of Surgery, Medical College, Dacca.
Submitted for publication March 18, 1954.

The method to be described here carried a comparatively low mortality even in the years before any antibiotics or chemotherapeutics were available. Now, with all the modern advances in transfusion and intravenous feeding, the mortality rate should be definitely lower.

The first surgeon who approached the problem was H. Bircher (Germany), in 1894. He performed dermato-esophagoplasty in 2 cases, intending to use a skin tube, formed from the skin of the thorax and connected with the stomach, for connection. Both of his patients died shortly after the operation. Wullstein proposed an extrathoracic esophagojejunostomy; he used a high jejunal loop excluded and reimplanted end to side. The cervical portion of the esophagus and the aforementioned loop were to form an end-to-end anastomosis. In that way the whole of the stomach would be excluded from the digestive process. Wullstein never performed the operation on a living subject.

Roux went a step further; he performed an extrathoracic esophagojejunostomy. That is to say, the aboral part of the jejunal loop, used for connection with the cervical part of the esophagus, was not implanted into the jejunum but into the stomach.

It was not long before surgeons realized three basic principles of esophagoplasty; 1. It is not feasible to connect a skin tube with the stomach, because sooner or later the aboral part of the skin tube will be digested by the gastric juice. 2. It is very risky to bring the jejunal loop up to the neck. With all precautions, in many cases the whole or at least a great part of the loop became necrotic 3. Surgeons noticed in patients with esophagostomies that the swallowed fluid shot out from the opening with considerable force. This force in itself is sufficient to press any solid food down the skin tube, so that peristalsis of

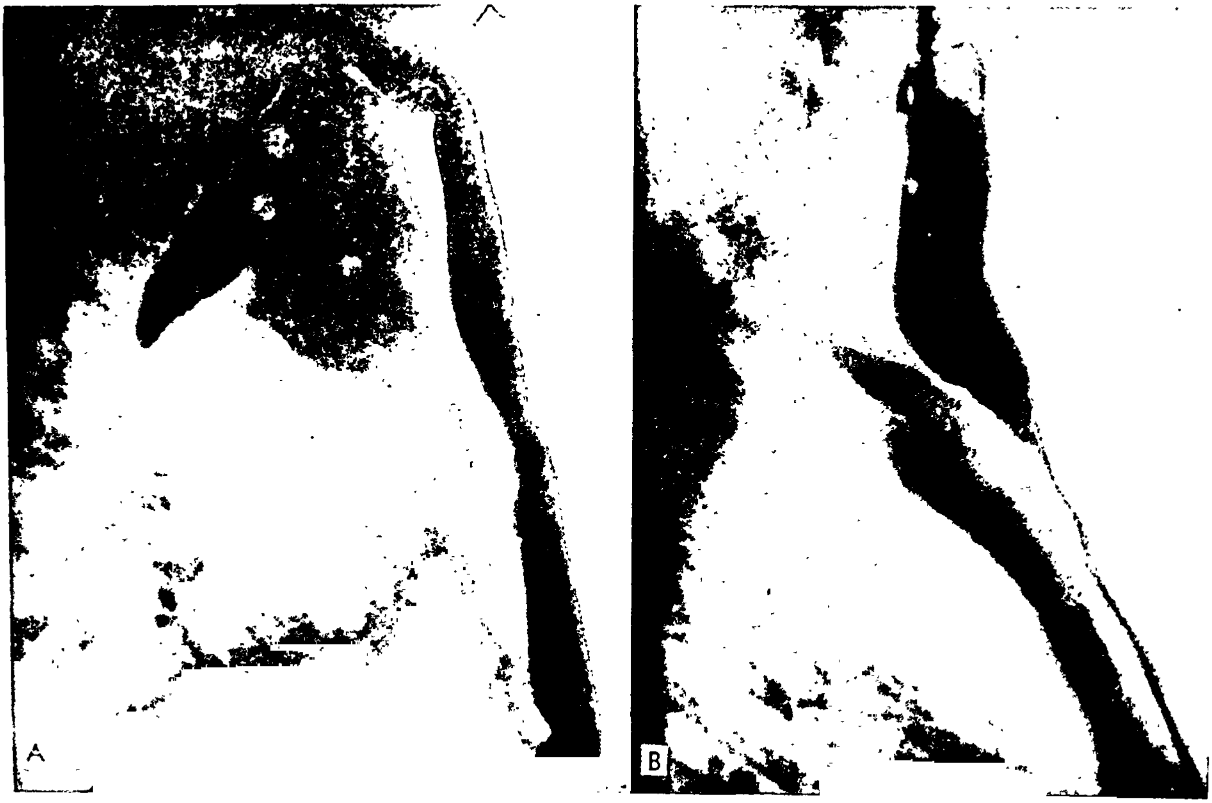

Fig. 1.—*A*, esophagoplasty with side opening of the esophagus into the skin tube. Filling of the blind sack of the esophagus. *B*, esophagoplasty with complete severing of the esophagus. The skin tube is starting to fill.

the jejunal loop is not at all necessary to move the food along the thorax. The end part of the tube will obtain some advantage from the peristalsis of the short connecting loop, but the main purpose of this loop is solely to prevent regurgitation of gastric juice into the skin tube.

By using a short loop only for connections, most of the dangers to life can be avoided.

On these general principles Lexer planned a method of esophagodermato-entero-gastrostomy. My work consisted of building up a routine, safe technic on the basis of Lexer's ingenious idea.

Before going into details in prescribing my own method, I wish to complete the enumeration of different technics of esophagoplasty by mentioning four methods which are basically different from those already described.

The connecting jejunum has been replaced by Kelling and Vulliet with the transverse colon (in an isoperistaltic or antiperistaltic manner). Roitz used the ascending portion of the colon in an isoperistaltic manner. I know of 3 cases from Hungary, in which all the patients recovered uneventfully and did very well.

Later I shall discuss the requirements as to the side of the jejunum to be used as connecting intestine. If these requirements are not present, but the colon is provided with a long and mobile mesocolon, the solution is convenient. Use of the colon seems not to augment the danger, despite the fact that all the patients within my knowledge were operated on long before the use of antibiotics and chemotherapeutics.

Generally it is possible to pull the colon higher than the jejunum, which seems to be an advantage. Although the length of the skin tube is of no importance, the length of the colon is rather a handicap, because the mobilized colon tends to dilatation and possesses only feeble peristalsis. In consequence, the food remains up to an hour and a half in the colon; a sort of first stomach is thus formed, and the patient is forced to massage the food into the actual stomach, if he wishes it to go down more quickly. In none of my 25 cases of jejunal connection have I observed any delay in the passage of food.

Using the method for gastrostomy of Depage and Jianu, Halpern and Hirsch worked out their esophagoplasty, in which they used a stomach tube formed from a section of the anterior wall of the stomach or from the greater curvature. The base of the flap in either instance is near the cardia.

Judging from the results obtained, the method has given fully satisfactory results. The gastric tube preserves some peristalsis, and the connection with the skin tube is not endangered. It may be that the gastric tube does not secrete juice in greater quantity, so that the juice, so dangerous to the skin tube, pours freely into the stomach and in consequence cannot be poured into the tube.

The stomach may be shrunken; in such a case the method is not applicable.

The greatest drawback is the danger that the blood supply to the tube will not be sufficient and that necrosis of the tube, even with fatal peritonitis, may ensue. Surely this is the reason that Jianu's method never gained popularity.

The most ingenious modification is Kirscher's. He uses the stomach itself for short-cutting the stenosed esophagus. The operation runs as follows: The stomach is mobilized from the cardiac end by ligating and cutting all the gastric vessels. Approaching the pylorus, the surgeon must be careful to conserve the vessels near the lesser and greater curvatures. The splenic vessels must not be injured. After mobilization is complete, the stomach is separated from the esophagus in such a way that a small part of the gastric wall is left with the esophagus. The stomach is closed. The esophageal end is connected with a jejunal loop brought high through the mesocolon. The continuity of the jejunum is restored by anastomosis. (Of course, if the operation is done in connection with a preceding esophagectomy, no such connection is needed.) The ensi-

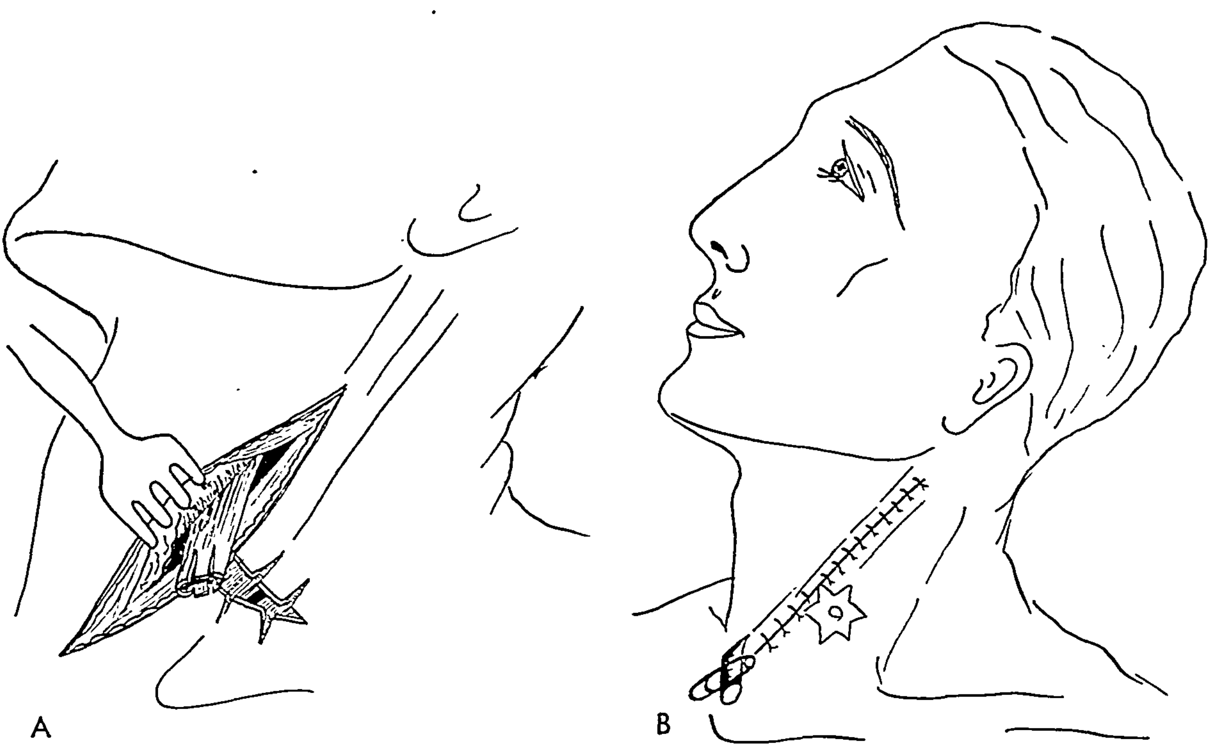

Fig. 2.—*A*, dissected esophagus with small incisions on its end, ready for suturing to the skin. *B*, esophagostomy performed; mediastinum drained.

form process is resected, the skin tunneled and the stomach pulled high. Usually it reaches the left supraclavicular region. The stomach loses its normal shape and is like a tube, the uppermost portion being the fundus. Meanwhile a separate team is dealing with the cervical and high thoracic portions of the esophagus in the usual manner, which I shall describe later, and the aboral end of the esophagus is brought down through the tunneled skin and put in connection with the fundus, if possible, in the manner of a gastric fistula.

The operation has distinct advantages. It can be completed in one stage. For connection the most physiologic organ, the stomach itself, is used. On the negative side there is the formidability of the operation. The whole gastric portion must be completed, lest the stomach shrink. Such an operation is not well tolerated by the debilitated patients who require it.

Apparently the complete vagotomy has no bad effect; the consequent atony is counterbalanced by the even pressure of the fibrosed tunnel.

The presence of a gastrostomy is not a contraindication. The gastrostomy can be readily closed before the operation.

According to my animal experiments, leading the stomach through the mediastinum is not to be recommended. The operation proved much larger and more dangerous, and if the animal survived the stomach showed a ballooning on inspiration.

Under what conditions is extrathoracic esophagoplasty indicated?

1. If the thoracic portion of the esophagus has been successfully removed because of a malignant tumor, and it is hoped that recurrence will not soon take place.

2. If there is extended, impermeable stricture, such as occurs most often after poisoning by corrosives; but foreign bodies housed too long in the esophagus, peptic ulcerations, chronic inflammations theoretically can be the cause, but they

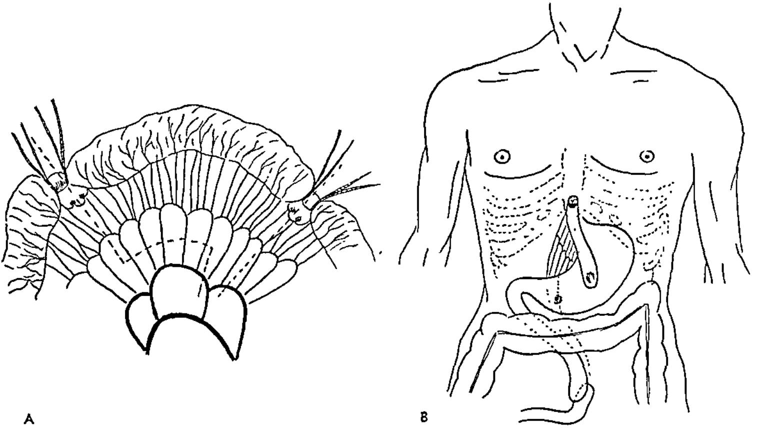

Fig. 3.—*A*, formation of the isolated loop for connection. *B*, retrocolic and retrogastric aspect of the mesentery of the isolated loop.

are not likely to lead to impermeable stricture, and if, the stricture is mostly limited in extension.

3. If there are incomplete extended strictures caused by corrosives, which cannot be brought under control by prolonged treatment.

In my opinion, if the dilatation is giving only a partial result and even this partial result cannot be maintained by periodic treatment, the stricture is likely to deteriorate to such an extent that only fluids can pass. Repeated dilation of such a stricture is not without danger. Whichever method is used, mediastinitis can be the consequence, owing to complete or incomplete rupture or inflammation.

Division by diathermy is far too dangerous to be advised.

In a case of more and more frequent recurrences, an error in the diet or a severe cold can obstruct the tiny patent part, and the patient must be fed through his gastrostomy. Such a patient will be more or less unable to continue his work or live a social life. More important, however, is the fact that, even with gastrostomy, the patient in most cases will die of some intercurrent disease in five or six years. In children, in inverse proportion to age, gastrostomy is even worse tolerated. A child under 10 could not tolerate a gastrostomy for more than two or three years. Whatever method he uses for feeding, the proper physiologic impulse to gastric secretion is diminished. Moreover, the patient is losing precious gastric juice. Gastrostomies, after some months or years, are no longer watertight. They are performed chiefly as emergency procedures and not always by the most experienced hands. Even if they are performed by experienced surgeons at the usual site, midway between the navel and the ensiform process, they will usually leak around the tube. At first it is possible to tighten them by pulling out the tube and replacing it only after half a day or so. Later this method would be useless. The diameter of the tube must be increased. Even this will not serve indefinitely. I have seen patients with enormous tube, which was made even more bulky with cloth, whose whole abdomen was virtually covered with painful dermatitis. I wish to stress the point that a leaking gastrostomy cannot be tightened by surgical means. If it is leaking it must be closed and a new one formed.

It is clear that delay in performing an esophagoplasty on such a patient will cause the situation to deteriorate. Both his organic and his nervous system will be exhausted, and the chances of his tolerating the operation will have diminished.

In cases in which I have the chance to perform the gastrostomy, I perform it below the left costal arch and in the middle. This site is well protected from intra-abdominal pressure. It is my experience that such a gastrostomy does not dilate, and when the plasty is finished it will usually close spontaneously if one scrapes out the epithelium and strips it with elastoplast. If it fails to close completely, operative closure is simple; the fistula will be very narrow, and one will not even need to open the peritoneal cavity. In spite of the somewhat macerated skin, primary union is the rule; these patients are building up, with time, considerable local and even general resistance against the bacilli concerned.

If I am in a position to choose the site of gastrostomy in the stomach I perform it high, as high as possible. If that is not feasible, I place it quite near the pylorus. If I decide to perform esophagoplasty the gastrostomy is temporary, and, in my experience, a gastrostomy near the pylorus does not disturb proper digestion. Gastrostomy in the middle of the stomach is very troublesome, because the site is needed later for connection with the jejunal loop.

My youngest patient was 5 years of age. He supported the esophagoplasty quite well. Controls showed that the newly formed esophagus grew with the child. My eldest patient, a 44-year-old woman with inactive, fibrotic tuberculosis and chronic myocarditis, supported the operation well and has suffered no relapse of pulmonary tuberculosis. Nevertheless, patients with active pulmonary tuberculosis must be excluded until the tuberculosis is controlled. For patients with inactive pulmonary tuberculosis, esophagoplasty offers security against relapse. Proper food intake can be secured only if the passage is restored. Taking into account the modern development of preoperative and postoperative treatment and free administration of blood during the operation, I should not put an age limit to esophagoplasty. The indication depends entirely on the condition of the individual patient. Of course, very old, marantic patients must be excluded. For them the only indication would be malignant tumor of the esophagus, and for such patients esophagectomy would be neither indicated nor feasible.

Syphilis or diabetes is not contraindicative *per se.* The indication depends on whether irreparable organic damages have been caused by the disease and whether the disease can be controlled before the operation. A positive Wassermann reaction after proper treatment is not a contraindication. I operated on a patient from whom we could not elicit a negative reaction in spite of repeated treatment. He supported the esophagoplasty without trouble.

All-important is the condition of the patient. One can start with the esophagoplasty only when this is adequate. The blood pressure must be around normal; anemia must be corrected. One cannot achieve this by artificial means alone. The most important point is to feed the patient properly. Patients after poisoning with corrosives generally have bad teeth, owing partly to the direct action of the corrosive and partly to lack of proper mastication. Most of them do not masticate well. They often turn the food in the mouth once or twice and use the syringe to press it into the stomach. To use the syringe instead of the funnel would not make any difference, but the inadequate mastication is bad for the teeth and even worse for the digestion. Such patients must eat frequently and not too much at a time and the food should be palatable and nourishing.

Prior to operation the teeth must be looked after.

Two patients had stricture of the esophagus and pyloric stenosis caused by the action of corrosive. In our opinion it is not right to short-cut the stomach and perform an esophagodermatoentero-anastomosis, as was done in some cases. We started with a gastrojejunostomy as the most simple solution. Stomal ulceration is not to be feared because of corrosive action; the acidity is low or anacidity is present. In some cases, perhaps, a gastroduodenostomy would be feasible.

In the following paragraphs I intend to describe our technic, which was developed in the First University Clinic for Surgery in Budapest (Director, Prof. Verebély) and later in the University Clinic for Surgical Technique in Kolozsvár (Director, Prof. von Novak) in 25 consecutive esophagoplasties. Eighteen patients have been operated on by myself and 7 by Prof. Borsos.

We started, as I have mentioned, with the operation of Lexer. Gaining more and more experience, we modified it. At last it seemed that our modified technic gave us reliable, good results, and we used it in our 20 later cases with no further alteration.

Our method is an esophagodermatojejunogastrostomy, in which the jejunum is used chiefly as a connection, the skin tube protecting part. It is an advantage if the jejunum can be brought high, and it is a handicap if one must be content with a short one. In the latter case, in forming and chiefly in covering the skin tube one faces unfavorable conditions while working in the more or less macerated and fibrosed skin around the gastrostomy opening.

In 2 of our cases the stricture extended practically up to the pharynx. In both we succeeded, with inverted skin flaps, in forming a permanent, non-narrowing connection between the pharynx and the surface of the neck.

The first question is whether the whole esophagoplasty shall be completed in one stage or divided into several.

It is definitely possible to complete the whole esophagoplasty in one stage. It was possible even before the great help of modern preoperative methods, and blood transfusion during operation were available. Nevertheless we gave it up, because we noticed that the formidable operation was very badly tolerated even by young and sturdy patients. At present our method is so planned that it can be easily divided into stages, which is of the greatest benefit not only for the safety of the patient but for smoother healing and a better final result. It must be pointed out that, if stricture occurs in any part of the completed esophagoplasty, dilation is practically impossible and only an operative correction can help.

If a gastrostomy has already been done, the first stage is forming an esophagostomy.

Although it is understood that modern anesthetics—cyclopropane, oxygen or light gas- oxygen — would not harm our patients, we consider local anesthesia even better, because it is less toxic; moreover, it does not require a skilled anesthetist and elaborate apparatus. It may be merely that we are accustomed to work with local anesthesia, which enables us to neglect the time factor. All of the stages are time-consuming, and a very delicate technic is required, with the best possible hemostasis. We appreciate greatly the advantages of local anesthesia, in that we are not bound to time at all. The local anesthetic technic we use will be described together with the successive stages of the operation.

We choose as the first stage the forming of an esophagostomy because this stage is not particularly dangerous; we can test the strength of the patient; it gives confidence to the patient for the long-lasting chain of operations, and the after-treatment and [illegible] l [illegible] ectio after this stage so [illegible] on siderable amount o

Before proceeding to this stage, in addition to routine examination and preoperative treatment, thorough examination must be made to locate the highest point of the stricture. That can be done by roentgenogram or esophagoscopic study or the two combined. In the immense majority of cases the highest point is around the bifurcation, rather above it. This place corresponds with the level of the third and fourth thoracic vertebrae.

From the day of admission of the patient the skin of the frontal part of the thorax is massaged to stretch the skin, so far as is possible, for formation of the skin tube. With women, because of the breasts, difficulty is rare. In children and men the stretching is very important because of the scarcity of skin.

For anesthesia we use cervical block on the left side, in a modification of Kulenkamff's method. This kind has proved harmless in many thousands of goiter operations. Parvertebral anesthesia of the neck is outdated because of the frequent accidents associated therewith.

The Kulenkampff method can be described as follows: In the middle of the posterior border of the sternomastoid muscle we place a wheal and inject 30 cc. of 0.5 per cent procaine hydrochloride just underneath the superficial fascia. The second wheal is placed ¼ inch (0.6 cm.) to the side and below the major cornu of the thyroid bone. Then 10 cc. of the 0.5 per cent procaine solution is injected around the superior thyroid artery, i. e., roughly 1 inch (2.5 cm.) underneath the cutaneous surface. Both of the injections can be done with a short, fine needle about 1 inch (2.5 cm.) long; accordingly, any deep or dangerous injection is safely omitted.

The incision is placed on the anterior border of the sternomastoid. In most cases the scar will be somewhat broad, cutting through the elastic fibers of the skin. We tried the cosmetic transverse incision but it was somewhat hindering to easy performance of the operation.

It is not possible to know beforehand whether the particular patient is likely to form abundant fibrous tissue. Consequently it is a good policy to resect corresponding parts of the sternohyoid, the sternothyroid and the sternal portion of the sternomastoid. The omohyoid and the facial vein are simply cut through between ligatures.

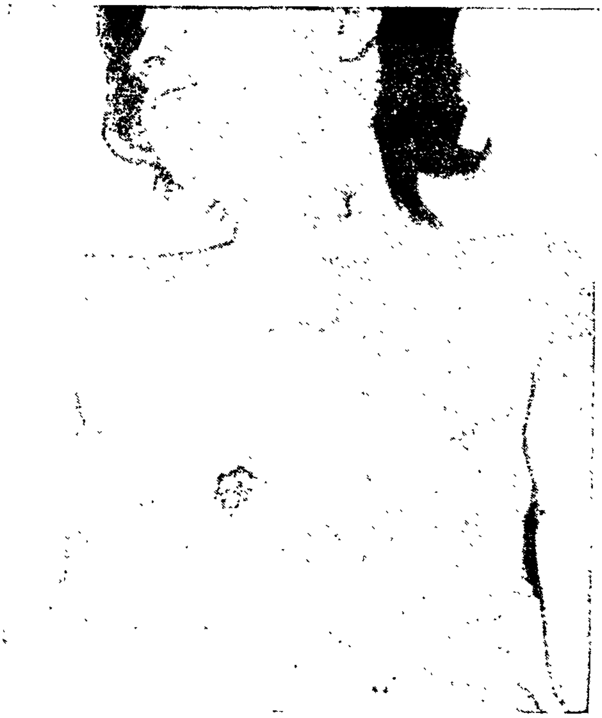

Fig. 4.—Esophagostomy and enterostomy ready for final stage.

With the great vessels retracted and the muscles to the side, the left lobe of the thyroid confronts the surgeon. The inferior thyroid artery is ligated far from the lobe and severed. If the lobe cannot be sufficiently retracted to the right, one might sever the superior thyroid. In older patients the simplest thing is to excise the left lobe and leave only the posterior part of the capsule and a thin portion of the adherent parenchyma. Behind the left lobe in the loose connective tissue is the esophagus. It is easy to recognize from its light pinkish color, strong muscular wall, and movement on swallowing. If there is any difficulty in recognizing the esophagus, a gastric tube can be introduced through the mouth.

Next, with the greatest delicacy, the esophagus is freed from the surrounding tissues. The recurrent nerve must not be injured during this act. The nerve runs on the wall of the trachea to a certain distance from the esophagus; therefore it cannot be injured if one approaches the esophagus during this phase of the operation.

For preparation, a small hard swab does the best service. The esophagus can be freed without bleeding. The best place to start is the midportion of the esophagus in the cervix. The organ is then freed in its whole circumference. A gauze sling facilitates the work considerably. Step by step the esophagus is followed into the mediastinum about 3 or 4 cm. Supposing that the complete stenosis is, as it was in most of our cases, at the height of the bifurcation, the esophagus above the stenotic area will be enlarged and surrounded by fibrous tissue. The utmost care is necessary not to damage the large vessels in the neighborhood. I do not speak of penetrating injuries; they are easy to avoid; I refer to nonpenetrating injuries of the veins, which later might lead to fatal bleeding if some mild infection develops.

The esophagus is liberated upward as far as it is easy. Five cm. of the esophagus, completely skeletonized, remains living.

Only in our first cases did we use the mobilized esophagus for end-to-side anastomosis with the skin tube (Fig. 1*A*). We soon realized that food first fills the blind sac of the esophagus, and passes into the skin tube only after that. Consequently, the greater part of the pharyngeal muscle action is lost. To avoid this inconvenience we transfix the esophagus doubly, just above the stricture, with strong chromic catgut, cut it through and bring the oral part to the skin surface of the neck. The aboral part is left in the mediastinum, and the wound is drained with a soft rubber tube, which is brought out separately from the main incision, on the deepest part of the neck, just in the midline (Fig. 1*B*).

We never have had any trouble with this method. This part of the mediastinum is fibrotic, and there is no danger of mediastinitis. The mucosa of the esophagus just above the stricture has been destroyed, or at least so damaged that no secretion is present, and therefore blind sac formation never occurred in our cases.

We fix the oral stump to a special incision, which is placed vertical to the main incision. By applying cuts 3 to 4 mm. long in the margin of this incision, and correspondingly cut the esophagus margin in the same manner, we will be able to suture the esophagus to the skin in the shape of a cogwheel. We have noticed that, if this is done, stenosis of the esophagostomy is less likely to occur (Fig. 2).

If the esophagus is not unduly skeletized and not unduly stretched, necrosis will hardly occur. Small marginal necrosis may occur, but correction is easy and there is plenty of time for it during the next stage.

In ten to fourteen days wound healing is so far advanced that one may start systematic swallowing exercises. The patient generally learns easily to use the esophagus in its new position and day by day the growing strength of the pharyngeal muscle action can be controlled.

In some weeks the esophagus will pull the surrounding skin inward and upward, facilitating the future connection with the skin tube.

In rare cases we might think it advantageous to dilate the oral stump. It is easy to do so from either the mouth or the esophagostomy. One thing must be emphasized: once the plasty is finished, there is no possibility of dilating with bougies. Strictured areas must be dealt with surgically.

We recommend high doses of atropine just before operation, but in postoperative treatment we do not use it, since it interferes with the cleansing effect of normal saliva.

Before the introduction of penicillin we used N.A.B. and bismuth to diminish the danger of infection from the mouth. For cleaning the mouth also we used N.A.B. solution. We cannot say whether penicillin fully replaces our N.A.B. treatment, which gave us very good service.

Before the second stage is undertaken, the patient must be given sufficient time to regain strength for supporting the most strenuous stage, the abdominal. Usually it takes two to three weeks to make the patient fit for this stage. It does not matter if the esophagostomy is not completely healed; there will be plenty of time to wait for that after the second stage.

The tissues surrounding the gastrostomy are more or less inflamed. We do our best to improve the skin condition. It must be mentioned, nevertheless, that such a prolonged inflammation induces a fair amount of local or even general immunity to the common pyogenic bacilli. The abdominal wound heals, as a rule, by primary intention.

Before this stage, if the gastrostomy has been performed elsewhere, one should determine roentgenographically on which part of the stomach the gastrostomy was performed. The incision will be planned on that side, since it offers a greater part of the stomach for implantation of the jejunal loop.

Prior to the operation the gastrostomy tube is removed for some hours to let the opening shrink, but it is replaced just before the operation as a guide to prevent damage of the wall of the fistula.

This stage too is carried out with local anesthesia—infiltration around the planned paramedian incision, and splanchnic anesthesia for the abdominal part, with 50 to 60 cc. of 0.5 per cent procaine hydrochloride. If there are many adhesions it may be necessary, after opening the abdomen, to administer a light general anesthesia for a short time. The most convenient is a small amount of Evipan.

The aim of this stage is to isolate a jejunal loop 18 to 20 cm. long, which has a sufficently long mesentery, and this could be pedunculated securely. Such a loop is likely to be found 30 to 40 cm. from the duodenojejunal juncture.

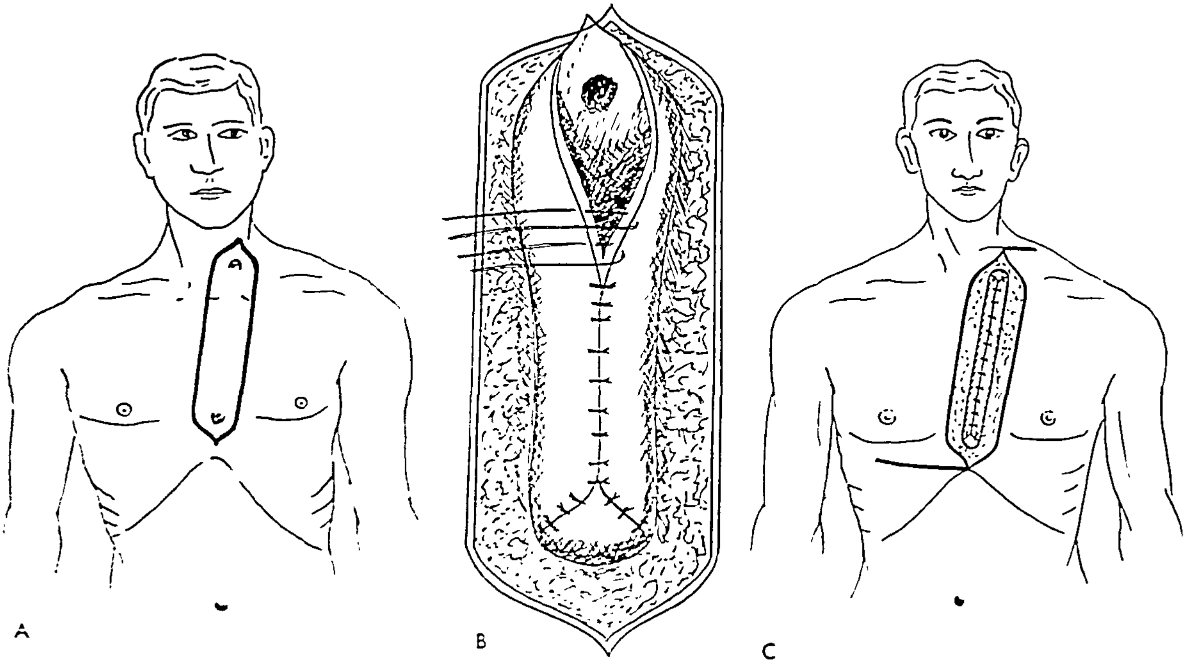

Fig. 5.—*A*, incision for skin tube with connections. *B*, accomplishment of the connections; closing of the skin tube. *C*, accessory incisions for covering the skin tube.

We must now survey briefly the arrangement of the blood vessels of the mesentery. The superior mesenteric artery branches into 15 or 16 intestinal arteries. These form an arch some centimeters from the roof of the mesentery. From the arch the vasa recta are derived, forming again an arch some centimeters from the bowel. This arch supplies the intestine with innumerable fine vessels.

One should choose a place where the mesentery is sufficiently long and one intestinal artery supplies a fair portion of the intestine; that is, the arch belonging to one intestinal artery corresponds to a broad portion of the arch supplied by the vasa recta.

The loop must be skeletized orally beneath the secondary arches, remaining in connection with the mesenteric arch by the intestinal artery. Aborally no skeletization is needed. Turning the mesentery against the light one compresses digitally one straight vessel after the other, watching the finest arteries of the loop to see whether they are pulsating normally. The pulsation must be not even slightly diminished. It must be taken into consideration that when the loop is brought high the vessels will invariably be slightly compressed. It is safer to be satisfied with a shorter loop than to jeopardize the adequate nutrition of a longer one. Repeating the procedure aforementioned, one might start by severing the mesentery. Aborally, without sacrificing a single straight vessel, there will be sufficient space to close the loop (Fig. 3*A*).

On the end the loop will be connected with a stem 1.5 to 2 cm. wide. One might try to suture the two peritoneal layers, but if the closure is pressing on the vessels, this must be avoided. Next the loop itself should be separated and the ends closed, with the sutures left long on the oral portion.

The continuity of the intestine is restored by side-to-side anastomosis. The isolated loop is gently pushed through the mesocolon and minor omentum above the stomach. The sutures left long in the oral portion will guide the loop.

The retrocolic and retrogastric way seems best. The colon and stomach cannot be pressed by the mesentery of the loop, whereas the vessels in the mesentery cannot be pressed by a somewhat dilated colon or stomach (Fig. 3*B*).

For transposition of the loop, one must open the gastrocolic ligament.

During the whole procedure the pulsation of the finest vessels on the oral end, as well as the color of the intestine must be watched. Pallor, deep cyanosis and patchy cyanosis are forecasts of danger. The loop must be pulled back below the colon, and pulled high only when the normal color and pulsation have been reestablished by packing it in hot compresses.

Supposing the isolated loop in the new position shows no sign of impaired circulation, connection must be made between the aboral portion of the loop and the stomach. The aboral end must fit exactly to the selected place on the anterior stomach wall. If it happens to be too long, one must invaginate the unnecessary portion or resect it. The anastomosis is side-to-side, lying in the vertical axis of the stomach. One inch long anastomosis is sufficient.

We do not use clamps, either here or elsewhere, except in cases of intestinal obstruction. We do not wish to damage the wall even in the slightest degree, and we do place emphasis on perfect hemostasis.

All the openings in the mesocolon and the gastrocolic ligament are now closed, the ensiform process is resected and the skin above the sternum tunneled. The oral end will be carefully pulled high by means of the long sutures on the oral end, and fixed to the skin if the circulation is still perfect. If signs of any impairment are present, except a slight bluish tinge, the loop must be pulled back to correct the malposition, that is, to eliminate the pressure. On no account can the abdomen be closed if the loop's circulation is not perfect.

The parietal peritoneum will be sewn as deep on the loop as possible to avoid peritoneal infection if gangrene of the loop should develop.

After this stage the stomach, as a rule, will be paralyzed three to five days. Through the gastrostomy tube the contents can be conveniently drained out. After that period we start to inject small amount of fluids into the stomach, meanwhile draining it out from time to time if necessary.

The greatest danger threatening the patient is partial or total gangrene of the loop. If one waits for the well-known signs of peritonitis, the patient will be lost.

If under the usual careful postoperative treatment (transfusion, plasma, infusion) the pulse rate is unduly increased and the volume and tension are deteriorating, the skin covering the oral end of the loop should be incised. If its circulation is normal, it may be secured again and the patient treated accordingly.

If there is a partial necrosis, the damaged portion should be resected. If the circulation is impaired, control of the loop and its mesentery should be maintained, even if one must cut out the connection with the stomach to change the position of the loop.

If there is thrombosis in the mesentery and the whole loop shows signs of incipient gangrene, the whole loop must be resected and the procedure repeated when the patient is again in fit condition.

In 1 of our cases the stomach was shrunken, and in the available anterior wall was the immensely dilated gastrostomy opening. We cut that out, closed the stomach, connected it from a new incision with the loop, and drained out the stomach through the oral end of the loop. The patient recovered. In this case, before the closing stage is performed, the stomach dilated sufficiently to allow us to form a new gastrostomy.

After ten to fourteen days the cutaneous covering of the oral end is incised, and the loop is opened and sutured securely to

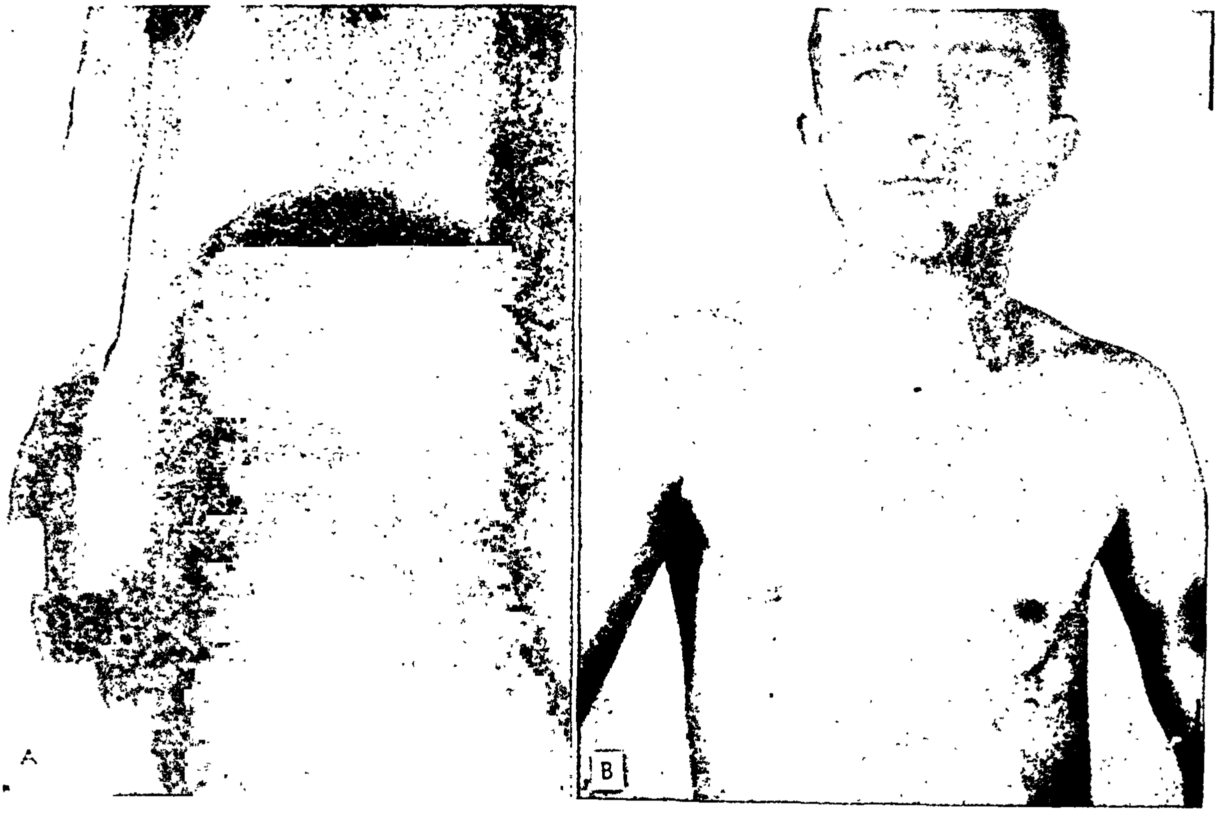

Fig. 6.—*A*, filling of the connecting loop. The already empty skin tube is outlined. *B*, completed esophagoplasty.

the cutaneous margin.

To proceed to the closing stage, the forming of the skin tube, is permissible only if both openings, the esophagostomy and the enterostomy, are sufficiently broad, and smooth, showing no signs of inflammation. The patient must have learned to swallow with the cervical portion of the esophagus in the new place, and the swallowed fluid must leave the esophagostomy in a strong arch (Fig. 4).

It must be clearly understood that, once the connection between the esophagostomy and enterostomy has been made, that is, the new esophagus has been completed, there is no possibility of further dilation. If there is a stricture, it must be cut out and the gap repaired.

The formation and function of the connecting skin tube is not at all hindered by the hairs. According to our experience the inverted hairs eventually degenerate and the skin lining is hairless. The skin tube is a connection between the esophagostomy and the enterostomy; hence the formation of the skin tube must be the closing stage and not the first, as it has been considered by some authors. With regard to the end result, the length of the skin tube does not matter. To adapt the esophagus and the intestine to a given tube is sometimes difficult and sometimes not even feasible. It is convenient if there is a low esophagostomy and a high enterostomy. Nevertheless, even if one must deal with a high esophagostomy and a low enterostomy, the skin connection is always feasible. A high esophagostomy will produce unesthetic scars on the neck. A connection with a low enterostomy is not quite so easy to perform, because of the hindering gastrostomy opening.

To insure with some certainty the smooth healing of the connecting skin tube, there are two requirements: The skin tube must be completely closed and covered with well-nourished skin flaps. The suture line of the skin tube and the covering skin must not lie in a corresponding line. If one abides by this rule, and later a fistula develops, the fistula will be an oblique one and will have a greater tendency to heal than does a straight one. There is no sure method of avoiding fistula formation. Fistulas form mostly around the esophagostomy, rarer around the enterostomy, and are very rare in connection with other parts of the skin tube. In the beginning, in some cases, we performed an end-to-end connection between the skin tube and the esophagus and the intestine respectively. Our later and standardized method is much simpler; we use for the anastomosis the surrounding skin of the esophagostomy and the enterostomy. It is simpler and surer, because we suture the same kind of tissue that is the skin. It gives more security for smooth healing.

The proper diameter of the skin tube is 2.5 cm.; therefore, we use for its formation a strip of skin 7 cm. wide. For children and for patients of delicate build we may be contented with a narrower strip. If a heavy dose of atropine sulfate is given preoperatively, the esophagostomy and the enterostomy will be kept dry. Moreover, they should be temporarily packed with iodoform gauze. We mark with compasses the 7 cm. below the enterostomy and above the esophagostomy and connect the two points, such having outlined the skin strip necessary for formation of the skin tube.

This stage can be also conveniently performed with local anesthesia. The infiltration is best done in stages; that is, only the region actually operated upon is infiltrated with 0.5 per cent solution of procaine hydrochloride. We infiltrate first the subcutaneous tissues between the two openings and make our incision according to the marked line. Starting from the skin margins of the strip, the latter will be only so far liberated as to permit the formation of a tube without tension. The hemostasis must be extremely careful. Throughout the whole plasty only the finest catgut is used. To gain sufficient strength for the sutures we suture in such a manner that we take into the sutures not only the subcutaneous layer b [illegible] dee part [illegible] skin itself, witho [illegible] (Fig. 5*A*).

After the union [illegible]

tube has been completed, one starts with the lower connection. The enterostomy is always less infected than is the esophagostomy. After due infiltration of the subcutaneous tissues around the enterostomy, the two parallel incisions are continued, and surrounding the opening 1.5 to 2 cm. distant, in the manner of a laurel leaf. This part of the skin is mobilized as far as necessary for tensionless closing. Closure is performed in the manner of an envelope. Then the upper connection is made exactly like the lower one, except that the "laurel leaf" points upward (Fig. 5*B*). On finishing the skin tube one must change gloves and instruments. In some cases it is possible to cover the skin tube by cautious dissection of the margins of the neighboring skin without tension. First one closes the two end points, i. e., the connections, and only after that the midpart. For tension sutures we use four point stitches. One cm. from the margin we pierce in 1 cm. inward from the margin, coming out on the other side, then turn and pierce 1 mm. in from the margin again and come out 1 mm. from the margin of the other side. In such a way there is no tension on the skin margin, and the skin is brought broadly to adaptation. Between these sutures we close with fine silk stitches and if there is no tension at all on the end, we may cut out the tension sutures at the end of the operation. We may use the stitches tied on pieces of gauze. The weak point is that the inner and outer suture lines cross each other.

If this method is not feasible because of tension, we may mobilize the skin of the breast with two long incisions. The lower incision runs parallel with the costal arch, from the lowest point of the operative skin defect, in a direction opposite the gastric fistula, to the right. According to the tension of the skin, it may be 10 to 15 cm. long. The other incision runs from the uppermost point of the skin defect, i. e., on the neck, in an oblique direction downward to the left (Fig. 5*C*). In this way two large triangular flaps are obtained, which allow tension-free closure after dissection. The advantage is that the inner and outer suture lines coincide at one single point. If fistulas arise, they will be oblique, and will have more likelihood of healing spontaneously. With other kinds of flaps the result is uncertain. The same is true of grafting, even if the defect to be covered is small. Drainage must not be used. Hemostasis must be perfect. The

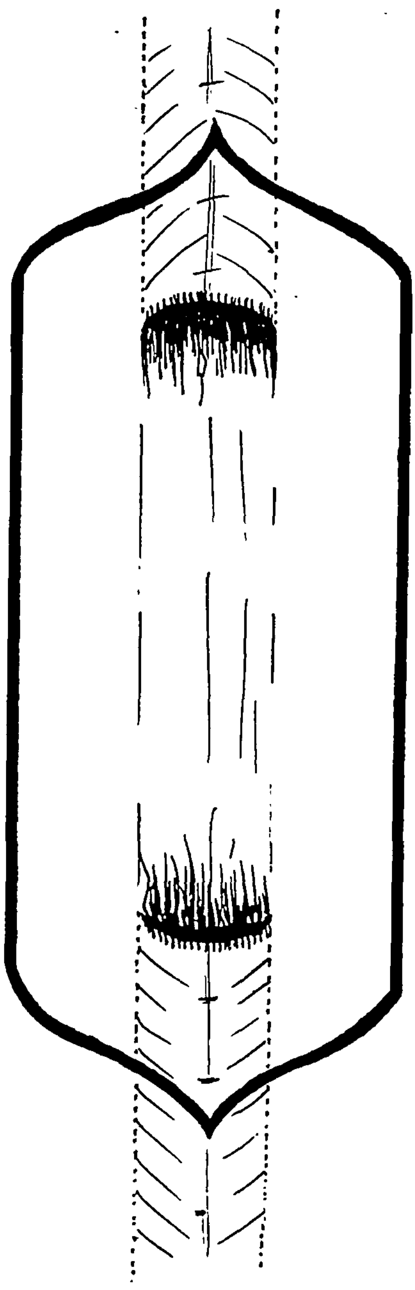

Fig. 7.—Repair of an extended area of loss of the skin tube.

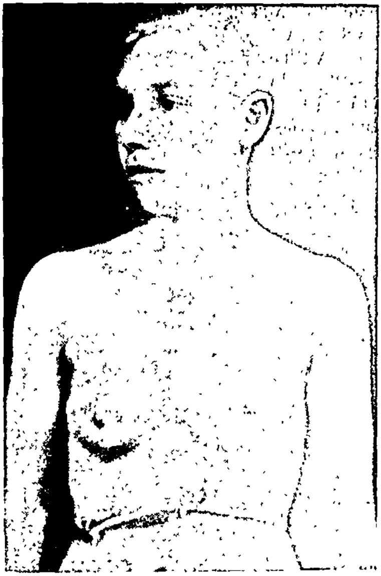

Fig. 8.—Considerable loss of the skin tube due to accident. Replaced with liberally cut sliding flaps.

skin lies snugly on the thorax, and there are no dead spaces. Primary healing is an exception, as is spreading infection. Mostly it amounts to a localized collection of pus; with the sacrifice of one or two stitches, healing is quick. Unfortunately a healing process so disturbed favors the occurrence of fistula.

The suture line is covered by mastix, and the arms are crossed and fixed on the thorax to give relaxation and rest to the skin.

For two days no food is given through the gastric tube. The gastric juice is drained out in order that it may not reach the skin tube and cause harm. After two *days the patient is given fluids through* the gastric tube. He must gargle frequently, using a weak N. A. B. solution, (0.45 in 2 pints of water, kept in a dark bottle). It is equally important to spit *out the saliva.* Atropine is not given; it dries the mouth, and in a dry mouth the germs thrive more vigorously.

Both when healing is primary and when fistulas are formed, feeding by mouth is started after fourteen days. Earlier oral feeding is inadvisable, because the food is a load for the suture line and the slight movements of the skin tube during deglutition presses the localized infection around the skin tube into the neighboring tissues. It is not wise to postpone feeding by fluids for more than fourteen days, because the fluids clean the skin tube and favor the healing of fistulas. During drinking, the fistulous openings are closed by the patient or by the nurse. First the patient is given weak tea without sugar; then gradually, other fluids, after which he should swallow a few sips of tea for cleaning purposes. In about two more weeks semisolid and solid foods are given. Extremely cold or hot fluids and spicy foods are not permitted even then. If the patient eats solid foods he should take small bites, chew well, and take some fluid between bites. After each meal the esophagus *must* be cleaned with a greater quantity of fluid. In general, the patient ought *to eat frequently,* but with the precautions indicated (Fig. 6).

*There are two dangers:* fistulas and stricture. To prevent fistula formation the *skin tube must be sutured* without tension and covered without tension in the same *stage, and the two suture* lines *must not* cross each other.

*If fistulas are starting to form,* strapping may be used. For fistulas in the upper part this procedure will not be particularly advantageous. One may achieve so much as to avoid opening greater parts of the plasty. It is of no use to scoop out the fistula and try to suture it. In the macerated skin the sutures will not hold, and in most cases such a procedure will be followed by enlargement of the fistula. The difficulty of healing is
is speedily covered with
within or
a small fistu

cut out the epithelial covering with a small scalpel. In very small fistulas the epithelium can be destroyed by chromic or nitrous acid. Strapping follows.

For closing a fistula, small flaps cut out from the neighboring skin are useless. The neighboring skin is macerated, badly nourished and fibrotic. Larger fistulas or gaping parts of the tube can be closed only with sliding flaps from distant healthy skin parts. The surrounding skin is used for forming the inner wall of the tube, in the manner of a wing or door. If, because of insufficiency of the sutures or

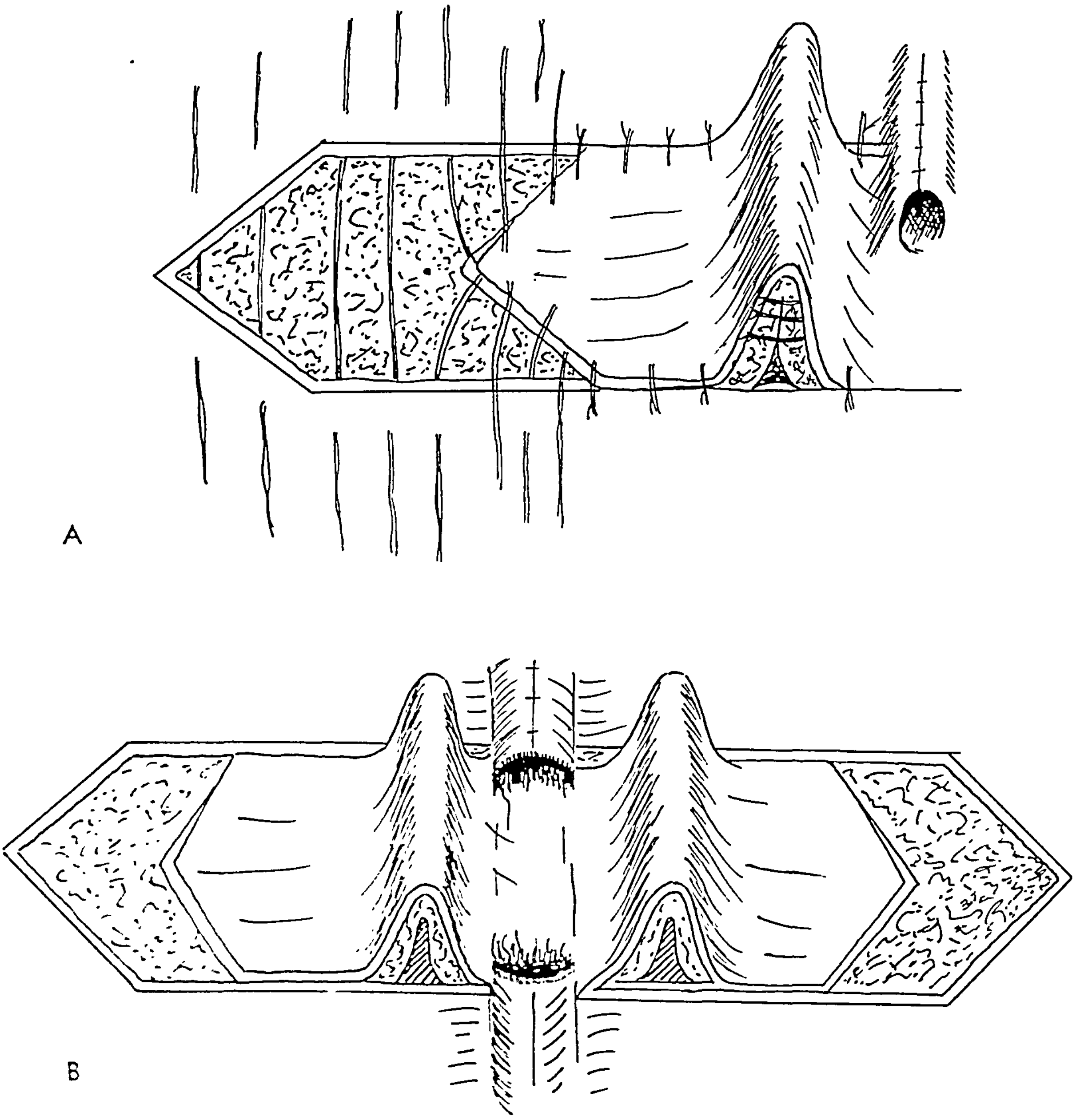

Fig. 9.—*A*, Gregoire's method for making the lower connection. *B*, repair of a defect in the skin tube by Gregoire's method.

excision of a strictured part, a considerable length of the skin tube is lost, the incision to form the replacement part must be placed on the covering skin of the remaining tube at the upper and lower end like a laurel leaf (Fig. 7). These two parts should be sutured like an envelope, as in covering the enterostomy or the esophagostomy. For covering one needs a sufficient amount of intact skin, which can be provided by liberally cut sliding flaps from distant healthy parts (Fig. 8). Pedicle flaps are rarely satisfactory. The sliding flaps of Gregoir are very useful, and we have employed it in our cases, always with success (Fig. 9).

A stricture cannot be relieved by bougienage. If it has formed it must be excised and the part covered either in the same stage or in a second.

We leave the gastrostomy open until the new esophagus, completely closed, has functioned for weeks without any difficulty. If the patient continues to swallow for four or five weeks without any difficulty and without the appearance of fistula or stricture, closing must be considered. If a correctly done fistula has not been too long in action, removing the tube, scooping out the epithelial covering of the fistula and skin strapping will bring about spontaneous closure. If the fistula is of long standing, the surrounding area is fibrosed because of the continuous inflammation. In such a case it is not likely that spontaneous closure will occur. The same is the case if the fistula is too broad or the mucosa is prolapsed. Still it is advisable to try spontaneous closure; at least the fistula will be narrower. Before the operative closure the heavily macerated skin must be improved. The best method seems to be to dry the skin—to leave it as far as possible without covering and to dry it with a hair dryer many times a day. On the day of operation we give a heavy dose of atropine sulfate. We have been forced to close the fistula when the skin was still macerated; nevertheless, we have not encountered any trouble in wound healing. If possible the closure must be made extraperitoneally.

Most of the patients have an inactive form of tuberculosis of the lungs; therefore complications referable to the respiratory system are the most frequent. The complications are a greater threat to the result of the plasty than to the life of the patient. One of our patients had highly toxic paratyphoid between two stages; another had pneumonia. During the complicating disease, fistulas developed on the endangered spots. We could close them only long after the complicating disease was healed.

We operated on 25 patients. Seven were operated on by Prof. Borsos in the First University Surgical Clinic in Budapest and 10 by myself. Eight have been operated on in the Surgical University Clinic in Kolozsvár. We lost 3 of the 25 patients. In 1 case the connecting intestine became gangrenous. Reoperation was done, but the patient died subsequently from peritonitis. The second patient had benign fibrotic pulmonary tuberculosis. After the first stage the tuberculosis flared up, and she died of caseous pneumonia. The third patient was a young married woman who was very much undernourished. The first stage went smoothly. The drainage tube in the mediastinum was taken out on the eighth postoperative day, and the patient left the bed and walked around. Nevertheless her condition deteriorated visibly. On the tenth day bleeding started from the mediastinum through the opening for the drainage tube. The patient lost about 300 cc. blood. The bleeding was stopped by packing the course, and a corresponding amount of blood was administered. Despite this, however, the patient died, showing symptoms and signs of failure of circulation. A postmortem examination was done. The bleeding vessel could not be identified. No bleeding was observed in the surrounding tissues. Central bronchopneumonia was the only pathological change. Apparently the patient was in such a low condition that she could not bear the damage of b[illegible]chopneumonia and of the blood loss; [illegible] not even respond with t[illegible] ing from broncho[illegible]

Two other questions must be answered: How long does it take to finish the reconstruction of the esophagus, and what are the final results? In exceptional cases the time can be surprisingly short. We have had a patient who left the clinic without fistulas in eight weeks. In some cases we finish the reconstruction in three months' time. The average time, including the time required to close the fistulas, was six months. When there were serious complications the healing period lasted up to a year. We could observe the forming of fistulas many months after influenza or pregnancy. Operative closure of such fistulas did not involve any special difficulty. The patients remain in contact with the clinic. At the time of writing, all of them are in good physical and mental condition and are working. Two of them have married each other. One was delivered without any complications from the site of the newly formed esophagus.

## SUMMARY

The author demonstrates the actual importance of extrathoracic esophagoplasty and outlines the history of its development.

Twenty-five consecutive patients have been operated upon, 20 by a modified Lexer procedure. Esophagodermatojejunogastrostomy was carried out. Of the 25 patients, 3 died.

The operative technic and the suitable local anesthetics are described. The operation, in the author's opinion, is preferably done in stages.

## ZUSAMMENFASSUNG

Der Verfasser stellt die Bedeutung der extrathorakalen Oesophagoplastik dar und gibt einen Überblick über die Geschichte der Entwicklung des Verfahrens.

An einer ununterbrochenen Reihe von 25 Kranken wurde die Oesophagodermatojejunogastrostomie ausgeführt, an 20 von diesen Fällen mit einem modifizierten Lexerschen Verfahren. Von den 25 Kranken starben drei.

Die Operationstechnik und geeignete örtliche Betäubungsmittel werden beschrieben. Der Verfasser ist der Meinung, dass die Operation am besten in mehreren Stadien ausgeführt wird.

## RÉSUMÉ

L'auteur démontre la réelle importance de l'oesophagoplastie extrathoracique et décrit l'histoire de son développement.

25 malades ont été opérés dont 20 par la méthode de Lexer, modifiée. On pratiqua une oesophagodermatojejuno-gastrostomie. Sur les 25 cas opérés, trois moururent.

L'auteur décrit la technique opératoire et l'anesthésie locale. D'après l'auteur, il est préférable de pratiquer cette intervention en plusieurs temps.

## RIASSUNTO

L'autore dimostra l'importanza dell'esofagoplastica extratoracica e ne sottolinea la storia del suo sviluppo. Furono operati 25 pazienti, 20 dei quali con la tecnica di Lexer modificata. Si praticò la esofagodermato-digiunogastrostomia. Su 25 pazienti ne morirono 3. Vengono descritte la tecnica operatoria e l'anestesia locale che più si addice. Secondo l'opinione degli AA. è preferibile che l'operazione venga fatta in più tempi.

## RESUMO

O autôr descreve a historia de desenvolvimento da plastica esofagiana por via extra-toracica, demonstrando o valôr atual dêsse metodo cirurgico.

Vinte e cinco doentes foram operados, sendo que 20 pelo processo de Lexer modificado, falecendo, do total, apenas 3 pacientes.

A técnica cirúrgica e a maneira de se processar a anestesia local são descritas,

salientando o autôr que a operação deve ser preferentemente praticada em diversos tempos.

RESUMEN

El autor demuestra la importancia actual de la esofagoplastía extratorácica y delínea su historia y desarrollo.

Dicha intervención ha sido practicada en 25 pacientes consecutivos, 20 por la técnica de Lexer modificada. Esofago-dermoyeyunogastrostomía. De los 25 pacientes murieron 3.

Se describen la técnica operatoria y la anestesia local adecuada. En la opinión del autor es preferible practicar la operación en dost miepos.

* * *

After all, a little good taste does no harm, and the fever of perfection is catching.

If with an excess of interest you peer into the lives of others, what you will probably find is that you have to pay their debts.

All mirrors are magical mirrors, and we never see our faces in them.

It is just as well to be a little giddy-pated, if you are to feel at home on this turning earth.

Amid the vast unimportance of all things, how beyond all calculation important we find it each morning to have at hand—in the face of Time and Eternity and the starry spaces—an adequate supply of thin paper!

Solvency is entirely a matter of temperament and not of income.

The world, as I know from books, is full of abominable evil;—indeed, I myself, not many years ago, had some collars stolen in the wash.

I might give my life for my friend, but he had better not ask me to do up a parcel.

—*Smith*

# Impending Death Under Anesthesia[**]

MAX THOREK, M.D., F.I.C.S.[*]

CHICAGO, ILLINOIS

CARDIAC arrest during anesthesia is the most terrifying emergency of the surgeon's career. Mastery of the situation demands a split-second decision and instantaneous action by the surgeon and the anesthetist, who must work together according to a well-defined plan.

Until recently the patient had hardly more than a 1:1,000 chance for survival. My attention was focused on this grim fact in June 1948, when the emergency occurred in my service. The fact that my associates and I were able to snatch the patient from the very jaws of death and that she eventually recovered all of her physical and mental faculties demonstrated vividly what quick action and precise teamwork can accomplish.

Many similar cases have since been reported. I have, therefore, undertaken to assess what has been accomplished in this highly specialized field during the past five years.

*Incidence of Cardiac Arrest.*—Palomera reviewed the literature on cardiac resuscitation in October 1952. He referred to Barber and Madden, who had collected 143 cases from 1848 to 1945. Dillon has noted that 6 deaths due to cardiac arrest occurred among 28,000 administrations of anesthetics between July 1946 and April 1948 in a general hospital. At the Lahey Clinic, 7 cases had occurred in thirteen years. Hamilton Bailey had reported approximately 2 cases a year; Cooley, 48 cases among 878 patients operated upon for pulmonic stenosis. Palomera commented that the true incidence is not easy to obtain, since few failures are reported. Cardiac arrest is most frequent during intrathoracic operations, especially upon the heart and great vessels.

Ament observed that 29 cases of cardiac arrest occurred among 28,000 major procedures at Bellevue Hospital in New York City, and Johnson encountered 20 cases during a three-year period at the Pennsylvania Hospital in Philadelphia. Eight of his patients had cardiac arrest after they had been returned to bed. Becker reported the frequency of sudden death in the operating room to be about 1 in each 1,000 cases of anesthesia administered.

In the last ten years, 11 cases of cardiac arrest have been observed at the American Hospital in Chicago. Five of these were in the practice of Dr. Philip Thorek and 6 in my own service. Of the 11 patients, 6 were saved by cardiac massage and 5 died.

Dr. J. William Hinton, Professor Surgery at New York University, has reported an increase in the incidence of sudden cardiac arrest, basing this statement on 1,344 cases throughout the United States. This includes cardiac standstill and ventricular fibrillation, and in Hinton's opinion the increase is due to (1) wider use of combined synthetic drugs and (2) the increase in the number of diagnostic studies requiring anesthesia. The survival rate for the 1,344 cases was only 28 per cent.

Hinton has also observed that 20 per cent of patients with cardiac arrest were under 10 years of age and that the incidence showed an abrupt decline in the years thereafter until the age of 40. It was noted that, whereas children normally have highly sensitive reflexes, this sensitivity gradually decreases with age, and, accordingly, the incidence of cardiac arrest declines. In the older age group, age-period changes in the vascular tree or lesions in the specific tissue seem to render the heart

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[**] H. Cushing Memorial Lecture, delivered at McGill University, Montreal, Canada, Jan. 15, 1954.

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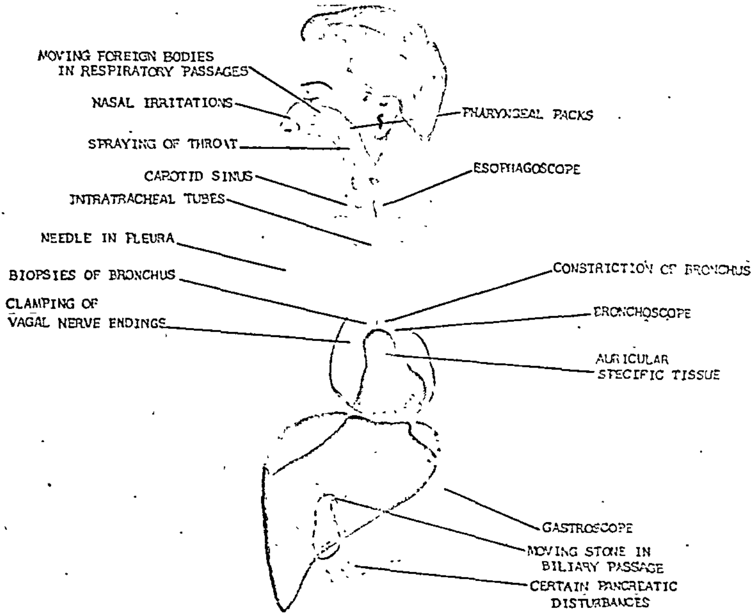

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Fig. 1.—Reflex areas from which cardiac arrest may eventuate.

increasingly vulnerable to vagal stimulation. Ventricular specific tissue seemed more depressed under the conditions that promote cardiac arrest when stimuli were initiated under the influence of anesthetic agents. Though at such times an undesirable reflex is not so likely to be set up, if it occurs it is more serious and more obvious than it would be in younger persons, in whom more active ventricular specific tissue is present.

*Etiologic Factors.*—Why one patient carefully examined and prepared preoperatively should pass through anesthesia and operation without incident, while another, who is apparently as good an operative risk, should undergo cardiac arrest remains a mystery. Existing disease of the heart and lungs naturally makes arrest more likely. Also, the incidence is greatly increased by any type of [illegible] surgical procedure. Cardiac [illegible] be expected more frequently in poorly nourished patients because of decreased glycogen reserve.

Cardiac and respiratory arrest may be (1) reflex (Fig. 1), due to vagovagal stimulation; (2) traumatic, due to injury to the heart or pericardium during operation; (3) the result of functional abnormality, such as ventricular fibrillation from an oversupply of epinephrine, either injected or secreted by the adrenal glands, or (4) induced by faulty selection or an overdose of the anesthetic.

Palomera listed eight significant etiologic factors: (1) myocardial deficiencies, especially those associated with areas of myocardial ischemia; (2) hormonal and chemical influences, such as excess of epinephrine, hypoglycemia, excess of pituitrin, variations of blood potassium, oxygen deficiencies and increase of carbon dioxide in the blood; (3) nervous influences; (4) hemorrhage; (5) actions of bacteria and toxins; (6) action of anesthetic agents; (7) action of barbiturates, and (8) pyrogenic and transfusion reactions.

Becker mentioned the preoperative mental state of the patient as an important etiologic factor. Strong emotions, such as fear, bring about an increased output of epinephrine, and some additional stimulus during the administration of even light anesthesia may induce ventricular fibrillation. Anemia may contribute to cardiorespiratory failure by increasing the degree of anoxemia and its attendant—hypoxia—which increases the sensitivity of the heart to acetylcholine. If vagovagal reflexes are initiated during an operation, acetylcholine is produced at the neuromyocardial junctions. If the cardiac sensitivity to acetylcholine is increased or the circulating cholinesterase decreased, the heart slows or stops. Thus, the surgeon, working in any area in which reflexes can be produced whose efferent pathways are through the vagi, may inadvertently bring about cardiac arrest by promoting an excessive production of acetylcholine.

The indiscriminate use of a variety of drugs is a potent factor in cardiac arrest. Both Dinsmore and Beecher commented on this fact, and Beecher stressed the role of muscle-relaxant drugs of the curare-like group.

Bonica classified acute cessation of cardiac activity into two convenient types: (1) arrest of stimulus formation (the so-called pacemaker failure), the result of which is cardiac asystole or standstill, and (2) electrodynamic dissolution of the cardiac cycle, as in ventricular fibrillation. Nelson and his associates stated that low oxygen levels in the blood stimulate the carotid sinus and the cardioinhibitory reflexes. A low oxygen content and a high carbon dioxide content each cause oversecretion of epinephrine. Hypoxia sensitizes the myocardium to epinephrine. These factors favor either fibrillation or standstill. Beck and Mautz indicated that general lack of oxygen usually causes cardiac standstill, while focal hypoxia of the myocardium favors fibrillation.

*Relation to Spinal Anesthesia*: As spinal anesthesia has been increasingly employed in recent years, more and more operating-room deaths have been charged to its account. There is no doubt that this technic, despite its immense and undeniable advantages, has complicated the problem presented by cardiac arrest. Babcock declared the ratio to be as low as 1:10,000, but other observers have placed it as high as 1:1,000. The exact mortality rate no doubt lies somewhere between these two extremes. It would seem to be an established fact that, other conditions being the same, more patients die under spinal anesthesia than would be likely to die under other types. The incidence of death under spinal anesthesia is apparently greatest among aged persons, so-called "poor operative risks" and Negroes. Seemingly, for young and healthy persons, a spinal anesthetic presents no greater hazard than any other.

*Genesis of Cardiac Arrest.*—Much confusion still exists among surgeons concerning the genesis of cardiac arrest. Ventricular fibrillation seems rare in comparison with the number of cases of cardiac arrest.

It has been stated that there is no specific tissue in the heart. Yet every few years the discovery of a new area with specific tissue characteristics is announced (Fig. 2). What is the "specific tissue"? There is no absolutely reliable anatomically distinguishing feature, but it is known to be the hardiest tissue in the body and can function for long periods without oxygen or even blood supply. Its capacity for automaticity is the outstanding feature, and every one of the millions of specific tissue fibers is in itself able to form a stimulus. The law of auxomeric conduction states that, as long as one healthy fiber of this tissue is present, conduction will be normal. The specific tissue is susceptible of revival to good function as long as seventy-two hours after death. In clinical terms, this means that widespread disease may exist in the specific tissue which, under ordinary conditions, might readily escape detection.

The distribution of the vagus in the specific tissue is restricted to the auricles. There are no vagal fibers in the mammalian ventricles. The specific tissue has the capacity to originate stimuli and is widely distributed throughout the auricles and ventricles. In a normal, healthy heart, no stimulus from any source, including the carotid sinus, can cause a general collapse, because the specific tissue in the ventricles, being free of vagal influences, can form stimuli and function autonomously and, as far as the circulation is concerned, in a perfectly satisfactory manner.

Anesthesia depresses the capacity of the specific tissue to form stimuli, and it responds to vagal stimulation as if there were widespread lesions with nonfunctioning elements. In other words, a heart under anesthesia is as vulnerable to vagal stimulation as would be a heart with widespread organic disease in the specific tissue without anesthesia.

Anoxia *per se* will not cause or initiate these reflexes, but its presence enormously potentiates the action of the anesthetic agent, with a still further depression of the capacity of the specific tissue to form stimuli.

The following case, together with others which have been reviewed, presents convincing evidence that cardiac and respiratory arrest during anesthesia is amenable to control under proper conditions when adequate technical skill is available and promptly applied.

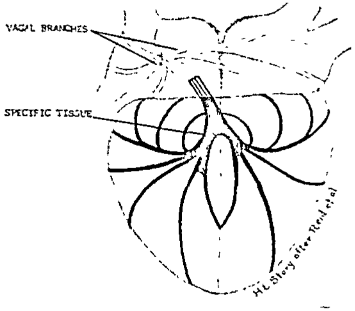


Fig. 2.—Distribution of "specific tissue" in mammalian ventricle.

### REPORT OF A CASE

A married woman aged 23 was admitted to the American Hospital on June 25, 1948, to be operated upon for chronic appendicitis. Prior to the administration of the anesthetic, the blood pressure in millimeters of mercury was 120 systolic and 800 diastolic. Premedication included the administration of 1½ gr. of nembutal two hours before operation and ¼ gr. of morphine sulphate with 1/200 gr. of scopalamine one hour later. Except for the appendicitis, the patient gave no evidence of organic disease.

Spinal anesthesia was employed, 14 mg. of pontocaine with 1 cc. of 10 per cent dextrose solution being injected into the subarachnoid space at the level of the third and fourth lumbar segments. The anesthesia reached the level of the eighth thoracic segment (the anesthetist stated afterward that it could not have risen above this level). On the table, the patient appeared apprehensive and was restless and uncooperative.

*Intravenous injection of 0.4 per cent solution* of pentothal sodium into the ankle vei[illegible] was begun not less t[illegible] ten [illegible]nutes administration of [illegible] tal of 0.35 gr. of [illegible]iste[illegible] by the continuo[illegible] of three to five minutes. During this time, the blood pressure was 100 systolic and 60 diastolic. One minute later, it dropped to 60 systolic and 0 diastolic.

The pentothal was discontinued and the blood pressure checked. It was 40 systolic and 0 diastolic. One-half minute later the systolic pressure had also disappeared. The patient was still breathing shallowly, but with apparently fair exchange. Her face was livid, and no carotid pulse could be detected by palpation.

Pure oxygen was immediately administered by mask. A check for the aortic pulse was without result. I immediately opened the diaphragm through a left superior rectus incision and began cardiac massage, at the same time ordering an intracardiac injection of epinephrine (0.5 cc., 1:10,000). Massage had been continued for five or six minutes before the heart resumed spontaneous activity. During this time the patient, whose respirations had now also ceased was intubated and artificial respiration with pure oxygen begun. Administration of 5 per cent dextrose in water was started in the foot and the apparatus set to run as rapidly as possible. When the heart action was firmly reestablished, appendectomy was carried out through the incision already made. The total period of cardiac arrest was nineteen minutes.

The patient remained in coma four days, giving no response to painful stimuli; the pupils were fixed and dilated, and a classic Magnus de Kline phenomenon, as well as a continuous bilateral Babinski sign, was present. On the day of operation one had gained the impression of cortical degeneration secondary to cerebral anoxia. A bilateral stellate block was performed and was repeated on each of the two following days.

On the first postoperative day, spinal puncture yielded normal fluid under a pressure of 280 mm.; the coma seemed even deeper.

On the second postoperative day the patient was still in deep coma, but not quite so oblivious as before. On the third day her condition was worse, with repeated vomiting. On the fourth day the sensorium was slightly clearer, and on the fifth there was definite, if slight, improvement. By the end of the seventh day she had regained full consciousness, although motor weakness was still marked in the extremities. The reflexes remained unchanged.

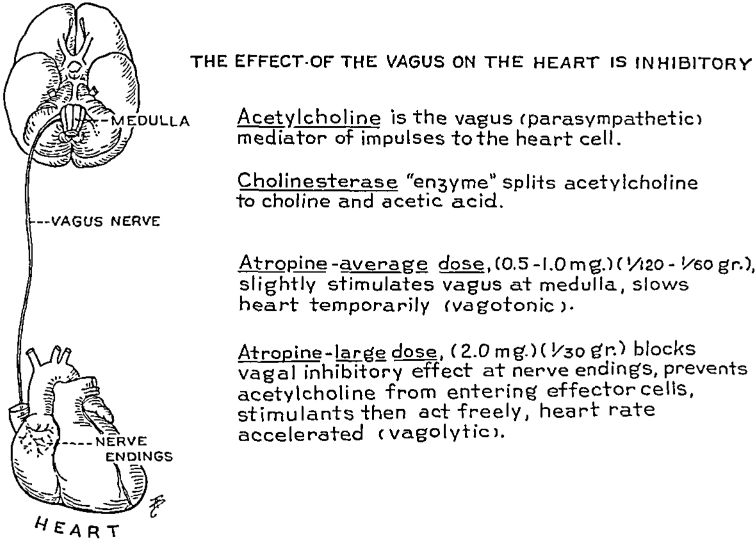
On the seventeenth postoperative day the patient walked with assistance, though her gait was staggering and insecure and her gaze fixed on the ground. Babinski and Gonda signs were still marked on the left, but less pronounced on the right.

Thereafter, her progress was steady. On the thirty-second postoperative day she had so improved that her discharge from the hospital was considered; she could walk alone and was steadily gaining strength. On discharge from the hospital, her mental condition was still somewhat befogged and her speech hesitant, but thereafter improvement was constant. By November, the finer movements of the extremities were completely restored, and her speech was practically normal. She was then two and a half months pregnant, her gestation proceeding without untoward manifestations of any kind. Her delivery, after three hours of labor, was without incident; no anesthetic was used. The boy weighed 7 pounds and 7 ounces (3,373 Gm.) and was healthy.

*Biochemistry of Brain Damage.*—It is known that nerve cells of the brain are more sensitive to lack of oxygen than are any other body cells. The general attitude has been that the remote effects of cerebral damage due to anoxia are irreversible and that the extent of damage will always be determined by the length of time the brain is deprived of oxygen. The generally accepted dictum has been that the brain will not stand more than five minutes of oxygen deprivation without sustaining irreparable injury.

Yet, in my review of recent literature on cardiac arrest, I found some cases in which complete restoration of brain function took place when the period of arrest had been considerably in excess of that time limit. In the case reported by James C. Fox, Jr., there were twenty-seven minutes of ventricular fibrillation, but there was no permanent injury to the brain. In my own case the heart was arrested for nineteen minutes; the postoperative course was stormy, yet recovery apparently was complete.

McGinty and Gesell noted that during the first four minutes the lactic acid content of the brain was doubled and that after about ten minutes it was increased to a maximum of two and one-half times the normal. This local acidosis, in their opin-



THE EFFECT OF THE VAGUS ON THE HEART IS INHIBITORY

Acetylcholine is the vagus (parasympathetic) mediator of impulses to the heart cell.

Cholinesterase "enzyme" splits acetylcholine to choline and acetic acid.

Atropine-average dose, (0.5-1.0 mg.) (1/120 - 1/60 gr.), slightly stimulates vagus at medulla, slows heart temporarily (vagotonic).

Atropine-large dose, (2.0 mg.) (1/30 gr.) blocks vagal inhibitory effect at nerve endings, prevents acetylcholine from entering effector cells, stimulants then act freely, heart rate accelerated (vagolytic).

Fig. 3 (see text).

ion, plays an important part in the proteolytic process of the ganglion cells. Another investigator demonstrated that anoxia damages nerve cells at the outset by acute demineralization. There follows a slow return to normal, requiring from two to three months.

Haglund reported the following case:

A girl aged 15 months was given open-drop ether anesthesia for removal of a screw from the left main bronchus. The foreign body was easily located and grasped with tongs, but it was impossible to draw the screw head into the bronchoscope. The surgeon attempted to withdraw the instrument and the screw simultaneously, but the screw head was impacted between the vocal cords, which went into acute spasm. The patient made one or two gasping, violent respiratory efforts and then lay flaccid, the ashen-gray color of her skin indicating the possibility of cardiac standstill provoked by acute anoxia and intense vagovagal reflexes. Tracheotomy was at once performed and artificial respiration with pure oxygen administered. Epinephrine was injected intracardially, but not until nine minutes had elapsed was the chest opened and a "flaccid, dilated heart" palpated. After no more than one minute of cardiac massage, spontaneous heart action was restored. Spontaneous respiration was resumed ten minutes later.

The patient remained in deep coma, and after five hours the body temperature rose to 39.5 C. The pyrexia was combated by cool sponging, with the administration of antipyretics in small doses. The patient's condition remained almost unchanged for many days, but "little by little 'normal' reactions increased." After seven weeks, the child cried and made deprecating gestures when disturbed by moving, pinching, feeding and so on. After ten weeks she "probably reacted to sounds" but not to light. An electroencephalogram showed increasing cerebral activity. In two more months there was continued regression, according to the electroencephalogram, but after six months the clinical picture was unchanged and tube-feed' as necess

Fox's case, as , i cates the possib' on

are reversible. In his case the visual and sensory cortices were particularly vulnerable to the injurious anoxic effects, as was shown by severe and prolonged loss of vision and marked astereognosis. It would seem that the so-called "higher" centers are more easily injured by being deprived of oxygenated blood than are the lower ones. Proof of this was offered by Lennox, Gibbs and Gibbs in 1937, when they showed that their subjects became unconscious when oxygen saturation of the blood in the jugular vein fell below 24 per cent, whereas the lower centers continued to function. Other evidence supports the facts of a decrease in the metabolic rate and a gradient in vascularity as the neuraxis descends from the cortex of the brain to the spinal cord.

Weinberger and the Gibbons, in 1940, made histologic studies of the brains of cats subjected to circulatory arrest lasting seven and one-half minutes. They demonstrated that the motor and visual areas of the cortex sustained the earliest and most profound damage. The olfactory, orbital and temporal regions of the cortex were least affected. Their experiments showed that if cardiac arrest is promptly and effectively handled, and the heart revives, it is unlikely that the brain will suffer irreparable damage. The condition is in striking contrast to cerebral anoxia due to carbon dioxide poisoning or an overdose of narcotic drugs. Here the pathologic changes have a greater tendency to be irreversible, being characterized by widespread foci of necrosis and degeneration involving the corpus striatum.

*Prophylaxis.*—Adequate oxygenation at all times is a "must" in the prophylaxis of cardiac arrest. Prompt treatment of arrhythmias, likewise, is all-important. This is done by the use of procaine or "pronestyl" and atropine. The two agents will help to counteract the arrhythmias that are usually the precursors of cardiac arrest. Since vitamin B complex is unusually important for smooth cardiac function in any state of deficient nutrition, its adequate preoperative use is most valuable. During any endocrine imbalance, such as accompanies the climacteric, substitution therapy is a good preoperative measure, and if there is any disturbance in cardiac dynamics such therapy is essential.

*Effects of Vagus* (Fig. 3).—(1) The effect of the vagus on the heart is inhibitory; (2) vagus (parasympathetic) mediator is acetylcholine; (3) cholinesterase enzyme splits acetylcholine to choline and acetic acid to become inactivated at a slow rate compatible with normal physiologic action; (4) atropine can prevent acetylcholine from entering effector cells; (5) atropine alters cardiac rate; (6) biphasic action on heart: *vagotomic* a) 0.5 to 1 mg. (1/20 to 1/60 gr.), average dose, slightly stimulates the vagus at the medulla to slow the heart rate temporarily; *vagolitic* b) 2 mg. (1/30 gr.), large dose, blocks the vagal effect at the nerve endings on the sinoauricular pacemaker and causes acceleration of the heart rate; (7) influence of large doses of atropine is always most noticeable in healthy young adults in whom the influence of the vagus on the cardiac pacemaker is at its peak—in infants and aged persons large doses of atropine may fail entirely to quicken the heart rate; (8) adequate doses of atropine will remove the heart from vagal control and lessen the degree or halt heart block in which a vagal component exists as an etiologic factor; (9) toxic doses of atropine, on the other hand, may in themselves cause V-A block.

*Diagnosis.*—The effects of an abrupt interruption of cerebral blood flow are due to anoxia, hypoglycemia and an increase in extracellular potassium induced by anoxia; these all contribute to impairment of function. Among the early warning signs are changes in cardiac rhythm, reduced oxygen tension of the blood and an increase in the rate and depth of the patient's respiration. Later, breathing becomes labored, the accessory respiratory muscles being used, and cyanosis may then be detectable. Initially there may be a rise in blood pressure, but this is followed by a steady decline, with sudden vasodilatation.

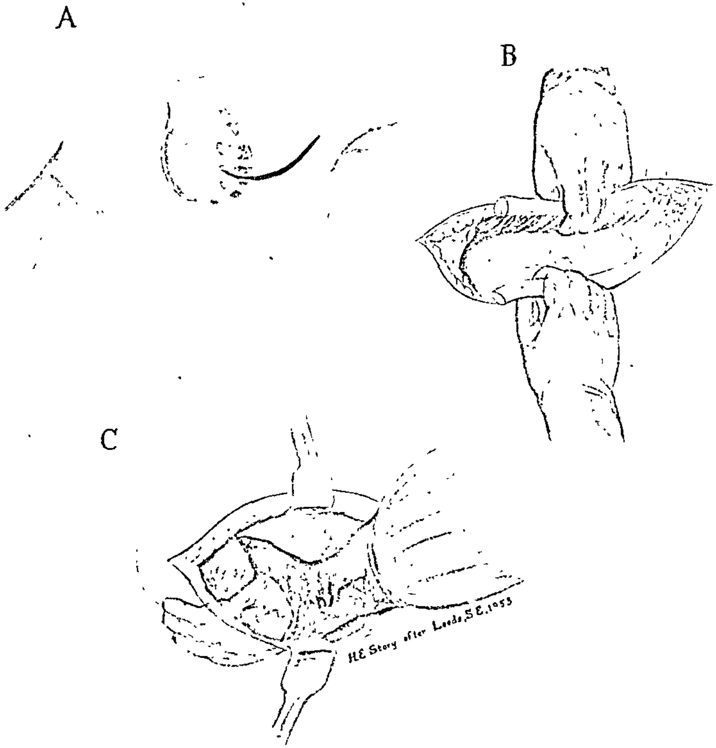


Fig. 4.—Transthoracic approach to heart in cases of cardiac arrest. *A*, incision; *B*, widening area of approach; *C*, cardiac massage.

The chief signs and symptoms of cardiac arrest are: (1) stoppage of breathing; (2) disappearance of pulse beat, blood pressure and cardiac sounds; (3) absence of bleeding in the operative wound, and (4) pallor or cyanosis. If anoxia is far enough advanced, the pupils may be dilated.

The stoppage of respiration is usually the initial symptom. When this is noted, the anesthetist should immediately feel the pulse to determine the state of the circulation. If the surgeon has access to one of the large arteries, he should test it by palpation; similarly, if the abdominal or thoracic cavity has already been opened, he should palpate the heart from below (abdominal incision) or examine it by direct observation (thoracic incision).

Direct observation, either of the heart itself or of one of the great arteries, is the only certain way to answer the one all-important question: Has the heart actually ceased to beat? Visualization of the retina, often advocated, involves the time-consuming use of the ophthalmoscope and is less certain in its results. Electrocardiographic tracings are not to be relied upon. The same may be said of the absence of capillary refill (often difficult to evaluate, especially in dark-skinned persons). The carotid pulse usually gives the most reliable information.

*Treatment.*—During the short period in which cardiac arrest can be diagnosed and emergency treatment begun, an adequate supply of blood must be furnished by cardiac massage and oxygenation of the blood by ventilation of the lungs. The importance of oxygenation cannot be overstressed. It is best accomplished by intermittent full distention and deflation of the lungs at the rate of 20 to 30 times per minute, preferably with an intratracheal catheter. With rhythmic compressions of the rebreathing bag, caution must be exercised not to use excessive pressure (preferably not over 16 mm. of mercury) lest damage to the lungs be encountered. If other means are not available, mechanical compressions of the chest with traction on the tongue, or even direct insufflation with the mouth over the cupped hand, should be used. The patient should be placed in slight Trendelenburg position to facilitate circulation. Artificial respiration, however, is useless unless the circulation is maintained. Cardiac massage is, therefore, an all-important factor in the treatment and must be started without delay. The institution of massage within three and a half minutes after the onset of cardiac standstill will successfully prevent irreversible damage to the brain, provided adequate oxygenation is maintained. The critical feature is the prevention of damage to the central nervous system by prolonged hypoxia. Conversely, it is believed that the interruption of blood flow through the brain for more than three to four minutes is likely to produce brain damage so great as to be incompatible with the preservation of life.

The approach to the heart has three routes: (1) transperitoneal subdiaphragmatic, (2) transperitoneal transdiaphragmatic and (3) transthoracic. The third, which is achieved by an incision in the fourth left costal interspace, with division of the costal cartilages above and below, gives the widest and most direct access to the heart (Fig. 4). However, it embarrasses pulmonary ventilation because of collapse of the left lung in the absence of a closed anesthetic system or respirator, and it takes longer for a surgeon without special training in thoracic work. For the general surgeon, the transperitoneal approach through the upper median or paramedian incision usually affords adequate exposure of the heart, is more familiar and may be more rapid. If the chest has already been opened, the location of the operative exposure will guide the surgeon.

In the emergency of cardiac arrest, clean hands and a keen knife are the essentials. Disregard skin preparations; act without delay. In the transthoracic approach, as stated, the incision should be made in the left fourth interspace, from the edge of the sternum to the posterior axillary line. There will be no bleeding. Carry the incision rapidly through the chest wall and pleura and, by introducing the hand between the fourth and fifth ribs, get to the heart. In the state of asystole the heart is flabby and motionless; in the state of ventricular fibrillation the heart will feel not unlike the proverbial "bag of worms."

In the treatment of ventricular standstill, Kay emphasized that injecting a stimulant without benefit of previous cardiac massage often brought on ventricular fibrillation, but after a few minutes of massage the injected substance was in the coronary vessels and in the myocardial bed. Massage prior to the injection increased the possibility of restoring the normal beat by means of the injected drug, as well as of preventing the occurrence of ventricular fibrillation. To obviate the danger of ventricular fibrillation, according to Barber and Madden, the injection should always be made into the right auricle. I have found 2 to 4 cc. of 10 per cent calcium chloride the most effective cardiac stimulant. But in Kay's experience, epinephrine hydrochloride almost always restored a normal beat, and when the first injection failed a second injection of the same strength was usually effective. It would seem safer to use a small dose of epinephrine hydrochloride and repeat the dose, or increase it if necessary, rather than to inject a large dose immediately and thereby run the risk of producing ventricular fibrillation.

In his experimental work, Kay considered that the most effective method of cardiac massage was as follows: With the operating surgeon on the left side of the table, the pericardium open and the left hand inserted through the left fifth interspace, the fingers are placed on the right side of the heart and the thenar eminence on the left side. The heart is then squeezed deliberately and firmly at a rate of 35 to 50 times a minute, which is rapid enough to maintain adequate circulation, yet does not tire the surgeon's hand.

If the surgeon has made his diagnosis without direct visualization of the heart, it may be advisable to try the maneuver suggested by Hamilton Bailey some twelve years ago. Thrust a needle into the right costal interspace of the upper rim of the fourth rib, close to the sternal border, directing it upward. This measure can be accomplished "in the twinkling of an eye," and, should it fail, cardiac massage should be instituted at once. The head of the table should be lowered so that the force of gravity will assist the first efforts of the reviving heart. Some form of artificial respiration should also be instituted, the direct method of which consists of rhythmic pressure on the lower part of the thorax. If this is not effective, it should be discontinued after one minute, and Silvester's artificial respiration should be performed. Adequate respiration then should be maintained with an anesthesia machine by manual compression of the breathing bag. One hundred per cent oxygen should be used and the patient provided with a tight-fitting face mask. Further, an endotracheal tube should be inserted until the patient is again well oxygenated. If the patient's trouble seems to be chiefly respiratory, as in cases of "blue asphyxia," it is important to clear the airway, pull the tongue forward, administer oxygen, remove any impaction of the epiglottis and begin direct or indirect artificial respiration. (Caiger encountered this situation 6 times and relieved it by pulling the tongue forward and lifting the epiglottis with the finger.)

Becker commented that the occasional success of intracardiac injections is probably due to the stimulus of the needle prick, "since the injection of a drug into the heart or anywhere else is illogical in the absence of circulation." He agreed, however, that if there is no immediate response to massage, 2 cc. of a 2 per cent solution of procain hydrochloride or Lahey's ready-prepared combination of 0.5 cc. of epinephrine, 1:1,000, and 9.5 cc. of 1 per cent procaine hydrochloride should immediately be given. If the patient is old or physically debilitated, it is the practice of Lahey and his associates to inject only 5 cc. The injection should be made directly into the right auricle or ventricle.

In the presence of ventricular fibrillation, massage must be continued without delay. It has been demonstrated that after fifteen or twenty minutes of massage the blood flow is reduced by vasodilatation, causing a poor venous return. This effect may be counteracted by rapid injection of fluid into the arterial system, which will restore the circulating volume and also increase the irritability of the heart by the pressure within its chamber. It has been observed further that more blood may be diverted to the brain by placing a vessel clamp across the thoracic portion of the aorta, releasing it every half hour to protect the viability of the other tissues.

Cardiac massage *per se* will not only fail to correct fibrillation but may actually aggravate it. In that event, 5 per cent procaine hydrochloride applied to the surface of the fibrillating ventricle has been proved effective in a[illegible] [illegible] action [illegible] heart.

The electric shock treatment of cardiac arrest has increased in popularity in recent years. An alternating current (60 cycles) of 1 to 1.5 amperes is passed through the heart for less than a second. Repetition of the shock may be necessary. (In animals, 0.4 ampere for five seconds will cause fibrillation, whereas 0.8 ampere or more will stop it).

There are a number of apparatuses on the market for defibrillation. Most of them are cumbersome and expensive. Dr. Herbert Trace and I have devised a simple method of defibrillation by the use of two applicators properly wired and attached to a wall socket (Figs. 5, 6 and 7). The instruments and equipment are as follows: 1 metal tablespoon; 1 spatula (flexible metal table knife); 35 feet of electrical household wire, insulated and insulating tape. The procedure is as follows: 1. Split 3 feet of the wire and solder one end to the spoon and one end to the spatula. 2. Cover with tape, leaving the bowl of the spoon and 2 inches (5 cm.) of spatula exposed. 3. To the other end of the wire attach an electric plug. 4. Test the instrument by placing an unconnected light bulb on a table; insert the plug in the socket and touch the spoon to the end of the bulb and the spatula to the screw portion of the bulb. If the bulb lights up the instrument is in working order. The use of the instrument for defibrillation is as follows: 1. Place the spoon under the heart, on the posterior surface of the ventricle. 2. Place the spatula on the anterior surface of the ventricle. 3. Make sure there is no metalic contact with other instruments (retractors, artery forceps, etc.), thus avoiding a short circuit. 4. Direct assistant to insert the plug in the wall socket and remove it quickly—in and out in about three-fourths of a second (a 60-cycle alternating current of 1 to 1.5 amperes passes through the heart). 5. Repeat as indicated by the circumstances in the individual case.

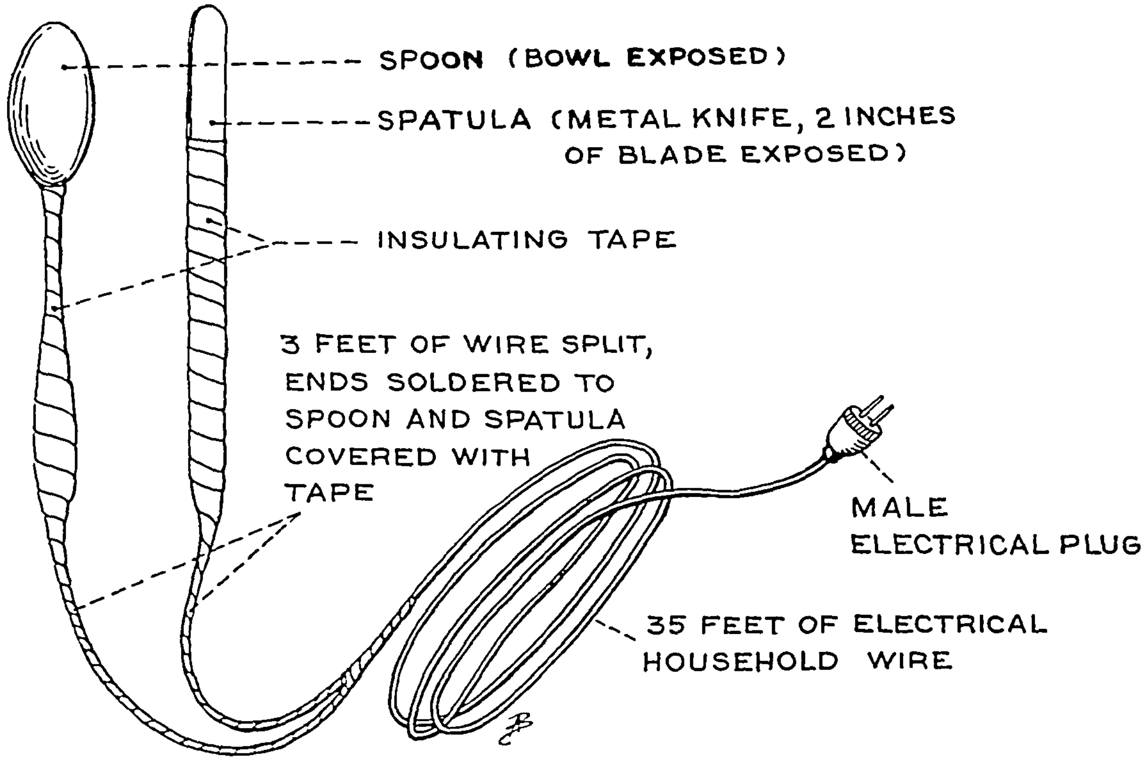

SPOON (BOWL EXPOSED)
SPATULA (METAL KNIFE, 2 INCHES OF BLADE EXPOSED)
INSULATING TAPE
3 FEET OF WIRE SPLIT, ENDS SOLDERED TO SPOON AND SPATULA COVERED WITH TAPE
MALE ELECTRICAL PLUG
35 FEET OF ELECTRICAL HOUSEHOLD WIRE

Fig. 5 (see text).

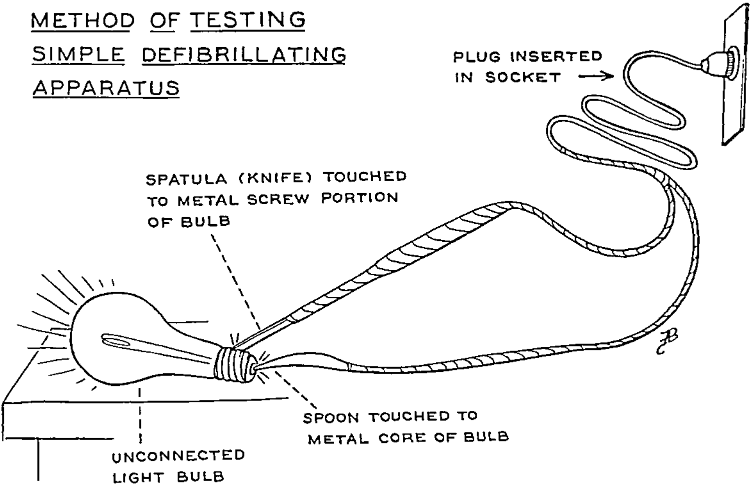
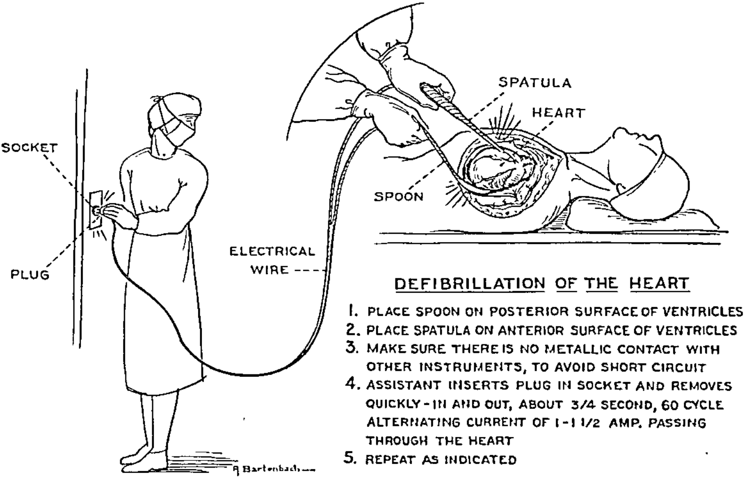

METHOD OF TESTING SIMPLE DEFIBRILLATING APPARATUS
PLUG INSERTED IN SOCKET
SPATULA (KNIFE) TOUCHED TO METAL SCREW PORTION OF BULB
SPOON TOUCHED TO METAL CORE OF BULB
UNCONNECTED LIGHT BULB

Fig. 6 (see text).



DEFIBRILLATION OF THE HEART

1. PLACE SPOON ON POSTERIOR SURFACE OF VENTRICLES
2. PLACE SPATULA ON ANTERIOR SURFACE OF VENTRICLES
3. MAKE SURE THERE IS NO METALLIC CONTACT WITH OTHER INSTRUMENTS, TO AVOID SHORT CIRCUIT
4. ASSISTANT INSERTS PLUG IN SOCKET AND REMOVES QUICKLY - IN AND OUT, ABOUT 3/4 SECOND, 60 CYCLE ALTERNATING CURRENT OF 1-1 1/2 AMP. PASSING THROUGH THE HEART
5. REPEAT AS INDICATED

Fig. 7 (see text).

In 1952, Zoll reported successful stimulation of the heart in 2 patients with complete heart block and cardiac arrest due to ventricular standstill. External electric stimulation by means of subcutaneous needle electrodes restored effective ventricular contractions. In 1 patient the heart was kept beating continuously by the artificial pacemaker for fifty-two hours of ventricular standstill.

Still another method of resuscitation of the arrested heart has been reported from Italy; intracarotid blood transfusion directed toward the brain, the common carotid artery being used. The purpose of this method is to supply the brain with blood more rapidly than is possible with intra-arterial blood transfusion directed toward the heart, thus reducing the hazards of dilatation and anoxia with permanent injury to the brain.

Automatic artificial respiration is most effectively achieved by means of the intratracheal tube. Another possibility is the use of a modern anesthetic machine to supply a high percentage of oxygen.

Hamilton Bailey has said, "A patient who inspires vomitus always dies; not necessarily at that time, but later, from bronchial pneumonia." If vomitus is inspired, promptly tilt the whole table to make use of the force of gravity; aspirate the material directly from the pharynx through the laryngoscope, and, when indicated, aspirate through a laryngotomy or do a tracheotomy.

By the procedures just described, "blue asphyxia" may be overcome in most instances. In cases of "white asphyxia" the difficulty is truly cardiac in origin and consequently far more dangerous. Cardiac massage should be undertaken at once.

The standard method of cardiac massage involves opening the abdomen to the midline from the xiphisternum. With the heel of the left hand pressing downward from the outside, the balls of the fingers of the right hand can exert effective pressure on the ventricles through the diaphragm. Nicholson's method differs from the standard method chiefly in the "buttonhole incision" which is made at once in the diaphragm behind the xiphisternum. That unforeseen complications may develop in massage of the heart was dramatically demonstrated in a case of rupture of the heart during this maneuver (Hurwitt and Seidenberg).

Collapse of the patient under intravenous anesthesia requires an antidote. This can be supplied by intravenous injection of a solution of picrotoxin 1:1,000 (1 mg. of picrotoxin acts as an antidote for 30 to 40 mg. of pentothal). The table should be instantly changed to the steep Trendelenberg position, and drugs that raise the blood pressure (e. g., methedrine) administered without delay. The blood pressure should be carefully watched throughout the remainder of the procedure and a constant saline drip maintained, with immediate increase of the flow should the pressure drop. It is notable that in comparatively few of the most recently reported cases of cardiac arrest did the emergency occur during spinal anesthesia. Of Best's 3 patients, the only one who recovered had had this form of anesthesia, Wolff's patient was undergoing thoracoplasty under spinal anesthesia, but suffered cardiac arrest just as the fourth cervical segment was being blocked. Prompt institution of cardiac massage and controlled respiration with oxygen restored the heart action within a few seconds, and later the thoracoplasty was done successfully with the patient under general anesthesia. It was thought possible that some trauma to the nerves of the pericardium might have taken place during the spinal injections, but direct proof was lacking. It is certain, however, that the innervation of the heart and pericardium is of the utmost importance in such a sequence. The pericardial nerves include fibers from the phrenic nerve—especially the left one—and also probably from the cardiac plexus.

Cardiac arrest in the case of Touroff and Adelman was explained as probably a vagovagal reflex arising from active manipulation of the left pulmonary hilus (during removal of a fibrosarcoma from the left main bronchus) and from irritation of the bronchial mucosa by intrabronchial hemorrhage.

It is not at all unlikely that the opening of the pericardium in my case similarly initiated cardiac function through reflex stimulation.

*Prognosis.*—The cause of cardiac asystole has much to do with the prognosis.

When a normal heart has received an overdose of anesthetic, the outlook is good. If it has been suddenly arrested because of reflex phenomena (vagovagal reflexes), it will usually start beating again rather easily and if the time of arrest does not exceed three minutes the prognosis is good. If it has stopped because anoxia has induced asystole or ventricular fibrillation, there is danger that the brain was damaged before cardiac action ceased, which makes the prognosis much graver.

According to Goran Haglund, the length of time for which artificial circulation must be kept up before the heart pump regains normal, spontaneous action seems to have no major influence.

In 1 fatal case the interval was but seven minutes. In another, in which the starting interval was less than one minute, artificial circulation had to be kept up for seventy minutes, but the patient eventually made a complete physical and mental recovery. Haglund's opinion, however, is that the length of time the patient is in coma has prognostic significance.

Becker stated that prognosis depends on the length of time elapsed before massage, whether the heart is in standstill or in ventricular fibrillation; the degree of glycogen reserve and hypoxia; the presence or absence of noxious drugs or hormones; and the degree of diastolic filling and coronary blood pressure produced by massage. It is much more difficult to cause resumption of a normal beat from ventricular fibrillation than from cardiac standstill, and the ultimate prognosis, of course, depends mainly upon the duration of inadequate circulation of oxygenated blood.

## SUMMARY

In the past ten years, 11 cases of cardiac arrest have been observed at the American Hospital of Chicago. Five of these were in the practice of Dr. Philip Thorek and 6 in the author's service. Six of the patients were saved by cardiac massage, and 5 died.

A review of the history and the literature of cardiac arrest and its treatment is presented. The etiology, incidence, diagnosis, treatment and prognosis are discussed.

A case of complete cardiac standstill lasting nineteen minutes is reported, and a simplified method of defibrillation has been suggested. The biochemical aspects of cerebral damage due to anoxia are discussed, and the possibility of reversing brain changes is illustrated by several cases cited from the recent literature. Though most authors agree that arrest lasting more than four minutes will do irreparable injury to the higher centers, several instances of complete recovery after much longer intervals are cited, and the conclusions of those making the reports are discussed.

Supply of oxygen to the brain and restoration of the heartbeat are the essentials to success. For this a good heart, normal lungs and adequate blood volume are a *sine qua non.* When there is severe cardiovascular disease or marked pulmonary fibrosis and inadequate blood replacement, the prognosis is grave.

## ZUSAMMENFASSUNG

Es wird ein Überblick über die Geschichte und das Schrifttum des Herzstillstandes und seiner Behandlung vorgelegt. Die Ätiologie, Häufikeit, Diagnose, Behandlung und Prognose werden erörtert.

Während der letzten zehn Jahre kamen im American Hospital of Chicago elf Fälle von Herzstillstand zur Beobachtung. Davon stammen fünf aus der Praxis von Dr. Philip Thorek und sechs aus dem Krankengut des Verfassers. Sechs Kranke wurden

durch Herzmassage gerettet, günf starben.

Es wird über einen neunzehn Minuten lang bestehenden vollständigen Herzstillstand berichtet und eine einfache Methode der Defibrillierung vorgeschlagen. Die biochemischen Faktoren, die bei der durch Sauerstoffarmut entstandenen Gehirnschädigung eine Rolle spielen, werden erörtert. Die Möglichkeit, Hirnveränderungen zur Norm zurückzubringen, wird an Hand einiger im neueren Schrifttum berichteten Fälle erläutert. Wenn auch die meisten Autoren darin übereinstimmen, dass ein länger als vier Minuten anhaltender Herzstillstand die höheren Zentren endgültig schädigt, so lassen sich doch einige Fälle völliger Wiederherstellung nach erheblich länger dauernden Unterbrechungen anführen. Die von den verschiedenen Autoren solcher Berichte gezogenen Schlussfolgerungen werden erörtert.

Der Erfolg hängt im Wesentlichen von der Sauerstoffzufuhr zum Gehirn und von der Wiederherstellung des Herzschlages ab. Um dies zu erreichen, ist das Bestehen eines guten Herzens, normaler Lungen und einer ausreichenden Blutmenge eine conditio sine qua non. Wenn eine schwere Herzgefässerkrankung oder eine erhebliche Lungenfibrose vorliegt oder der Blutersatz unzureichend ist, wird die Prognose ernst.

## RESUMEN

Se presenta una revisión de la historia y la literatura del paro cardíaco y su tratamiento. Se discute su etiología, incidencia, diagnóstico, tratamiento y pronóstico.

En los ultimos diez años, se han observado 11 caso de paro cardíaco en el Hospital Americano de Chicago. Cinco de ellos en el servicio del Dr. Philip Thorek y 6 en el servicio del autor. Seis de los pacientes fueron salvados por el masaje, habiendo muerto 5.

Se comunica un caso de paro cardíaco completo de diescinueve minutos de duración y se ejemplifica un método que se sugiere para desfibrilar. Se discuten los aspectos bioquímicos de la lesión cerebral debida a la anoxia, ilustrándose la reversibilidad de cambios vertebrales en casos citados en la literatura reciente. Aun cuando los autores estan de acuerdo en que el paro cardíaco de más de cuatro minutos produce una lesión irreparable de los centros superiores, se citan varios casos de recuperación completa después de un intervalo mayor de tiempo. Se discuten las conclusiones de los autores de las comunicaciones.

El aporte de oxígeno al cerebro y la restauración del latido Cardíaco son esenciales para el éxito. Para esto se requiere indispensablemente un buen corazón, pulmones normales y vol umen sanguíneo adecuado. Cuando existe padecimiento cardiopulmonar grave ó fibrosis pulmonary acentuada y remplazamiento sanguíneo inadecuado el pronóstico es grave.

## RESUMO

Uma revisão da história e da literatura sôbre a parada cardíaca e seu tratamento é apresentada. A etiologia, incidência, diagnóstico, tratamento e prognóstico são discutidos.

Nos últimos dez anos, 11 casos de parada cardíaca foram observados no American Hospital de Chicago. Seis dêstes pacientes foram salvos pela massagem cardíaca, e 5 faleceram.

Um caso de parada cardíaca completa com duração de 19 minutos é apresentado, e um método simplificado da desfibrilação é sugerido. Os aspectos bioquímicos da lesão cerebral devido a anoxia são discutidos e, a possibilidade de recuperar as alterações cerebrais é ilustrada por diversos caso citados na literatura recente. Embora a maioria dos autores concorde que a parada com duração superior a 4 minutos lesa irreparàvelmente os centros mais elevados, diversos casos de restabelecimento completo após intervalo muito maior são citados, e as conclusões daquêles que fazem as comunicações são discutidas.

O fornecimento de oxigênio ao cérebro e a restauração do batimento cardíaco são essenciais ao sucesso. Para isto um bom coração, pulmões normais e volume sanguíneo adequado constituem uma condição

*sine qua non.* Quando há afecção cardiovascular grave ou fibrose pulmonar acentuada e substituição inadequada de sangue, o prognóstico é grave.

RIASSUNTO

Viene fatta la storia e raccolta la letteratura dell'arresto cardiaco e della sua etiologia, frequenza, diagnosi, prognosi e cura. Negli ultimi 10 anni l'autore ne ha raccolto 11 casi dall'American Hospital di Chicago (6 personali e 5 del dr. Ph. Thorek) ; ne furono salvati 6 col massaggio cardiaco e 5 *morirono*. In un caso l'arresto si protrasse per 19 minuti. Vengono studiati gli aspetti biologici delle lesioni cerebrali da anossia e la possibilità di rimediare ad esse. Benchè si creda che dopo i 4 minuti le lesioni dei centri nervosi divengano irreversibili, sono noti casi in cui si ottenne la guarigione completa dopo un intervallo anche assai più lungo. I fattori del successo sono rappresentati dal rifornimento di ossigeno e dalla ripresa del ritmo cardiaco; condizione indispensabile è la normalità del cuore, dei polmoni e del volume sanguigno. In presenza di gravi malattie cardiovascolari o polmonari la prognosi è *infausta*.

◆

The man who threatens the world is always ridiculous; for the world can easily go on without him, and in a short time will cease to miss him.

Money and time are the heaviest burdens of life, and the unhappiest of all mortals are those who have more of either than they know how to use.

We love to overlook the boundaries which we do not wish to pass.

Nothing was ever said with uncommon felicity but by the co-operation of chance; and therefore wit, as well as valor, must be content to share its honors with fortune.

Differing from a man in doctrine is no reason why you should pull his house about his ears.

Self-love is often rather arrogant than blind; it does not hide our faults from ourselves, but persuades us that they escape the notice of others.

—*Johnson*

# Varying Relations of the Common Bile Duct with the Posterior Face of the Pancreatic Head in Negroes and White Persons

TRIESTE SMANIO, M.D., F.I.C.S.*
SAO PAULO, BRAZIL

THE literature indicates that there is no complete agreement as to the denomination and extension of the various segments dividing the ductus choledochus (common bile duct). All authors, however, agree in mentioning a portion related to the head of the pancreas, naming it retropancreatic, intrapancreatic, transpancreatic or simply pancreatic.

The intimate anatomic connections of the common duct with the posterior face of the pancreatic head are of great practical value. Authors have described the reciprocal relations of the biliary tract with the gland starting with the simplest type, in which the duct was found juxtaposed to its surface, only in contact with it and covered by loose connective tissue and by the duodenopancreatic coalescence blade, up to the most complicated type, in which there was a canal completely closed by pancreatic tissue. Concerning its constitution there is no perfect agreement; nevertheless it is of great significance from a surgical point of view. As a matter of fact, the first authors who dealt with the subject believed in the existence of a pancreatic tissue tunnel through which the choledochus canal would pass. Later researches brought about new observations and showed that in fact there was no tunnel but a glandular laminar extension of the pancreatic head, of varying thickness and size. It covered, partially or totally, the pancreatic segment of the common duct, the free border of which appeared adherent to the upper and posterior part of the head of the pancreas, leaving, however, a plane of cleavage (filled with connective tissue) that gave access to the biliary tract. Further interest was aroused by this fact concerning the elongation of the pancreatic head of varying length and height, on which excellent studies have been made by local and foreign researchers, and which, in 1898, was compared to a "languette" by Letulle and Nathan-Larrier.

The purpose of this work, which was directed by Prof. Odorico Machado de Sousa, is to describe the pancreatic "lingula" in Negroes and white persons of both sexes, in relation to its frequency and manner of appearance in the Brazilian environment.

*Review of the Literature.*—The bibliographic research was greatly facilitated by the list of works mentioned by Degni (1945). Other authors who carried out anatomic researches on the choledochus-pancreatic relation were also included.

Wyss (1866) mentioned two groups of researchers who referred to the relations of the common duct with the pancreas. In the first group were Krause, Werber and Luschka, who admitted that the common duct, before by-passing the duodenal wall, went through the head of the pancreas. In the second were Meyer, Hirtl, Durzy and Henle, who made no reference to this matter. In 22 cases the common duct crossed the pancreatic head.

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Helly (1898) observed approximately 70 cases, 40 of which were described in detail. Precise measurements were made. The common duct was always related to the *pancreas over 2 to 7 cm. Five different* types were distinguished:

1. The common duct was observed in a superficial groove in the pancreatic head, with which it was connected by dense connective tissue; the groove was 3 to 5 cm. long (9 cases).

2. The common duct was observed in a groove lateral to the pancreatic head, transformed into a canal by duodenopancreatic connections. The groove was 0.5 cm. long (6 cases).

3. The common duct was initially observed in a groove in the pancreatic head which farther along closed itself into a canal by the superposition of slender pancreatic lobules. The groove had an extension of 0.5 to 2.5 cm. and the canal one of 1.5 cm. (11 cases).

4. The common duct at first was observed in a groove and thereafter in a canal in the head of the pancreas which again became a groove. The groove was 0.5 to 2.5 cm. long in the first and 1 to 3 cm. long in the second portion, and the canal measured 0.5 to 2.5 cm. (7 cases).

5. *The entire terminal segment of the* common duct was observed in the canal of the pancreatic head, at variable depths and with lengths of 2 to 4 cm. (7 cases).

To the remaining cases the author made no special reference, mentioning that the statistics presented should not be considered an exact expression of the frequency of the different types. He did, however, *show the intimate relation between* the biliary tract and the pancreas. He also stressed the fact that, as a rule, the common duct entered into contact with the pancreas, though when point of confluence of the common cystic duct and the hepatic duct was caudal, the two ducts could meet in the pancreatic region.

Letulle and Nathan-Larrier (1898) *studied the relations of the common duct* with the pancreas in 19 of the 21 dissections. In 8 cases the common duct was lodged in the pancreatic head. In a majority of cases a simple small "lingula" or some pancreatic lobules were observed between the duodenum and the common duct, *at maximum depths of 2 to 3 cm.* In 11 cases the duct was loosely fixed by its anterior face to the duodenum and, more firmly, by its posterior face to the head of the pancreas. Measurements were made of the common duct, which confirmed the authors' impression that it gradually reduced itself as it neared the duodenal wall.

Wiart (1899) stated that, as a rule, the pancreatic groove existed where the common duct was lodged, the distal portion of which was deepened. The internal lip of the groove could almost cover completely the posterior face of the duct, so that it would seem intrapancreatic. The internal lip was removed by a probe and the common duct uncovered without cutting the glandular tissue. Of 10 cases, Wiart observed 3 in which distal portion of the common duct in its distal was included in a real pancreatic tunnel. The duct adhered lightly to the grooved walls and was easily freed. This portion of the common duct was called "retropancreatic," and the segment included in the thickness of the wall of the second portion of the duodenum was called "parietoduodenal".

Büngner (1903) examined 58 adult cadavers whose ages at death ranged from 23 to 81 years; 52 were male and 6 female. In 55 cases the common duct crossed the pancreatic substance obliquely to an extent of 2 cm. (maximum 4 to 5 cm. and minimum 8 mm.), and in 3 cases it passed laterally to the pancreatic head (twice "duodenally" and once dorsally).

The segment of the duct within the pancreas was covered in half of its course by a layer of pancreatic tissue 0.5 cm. thick on the average (maximum 2 cm. and minimum 2 mm.), and so firmly enclosed that it could not be dissected with the aid of blunt instruments.

The author stated that in [illegible] per cen [illegible] of the cases the co [illegible] ore

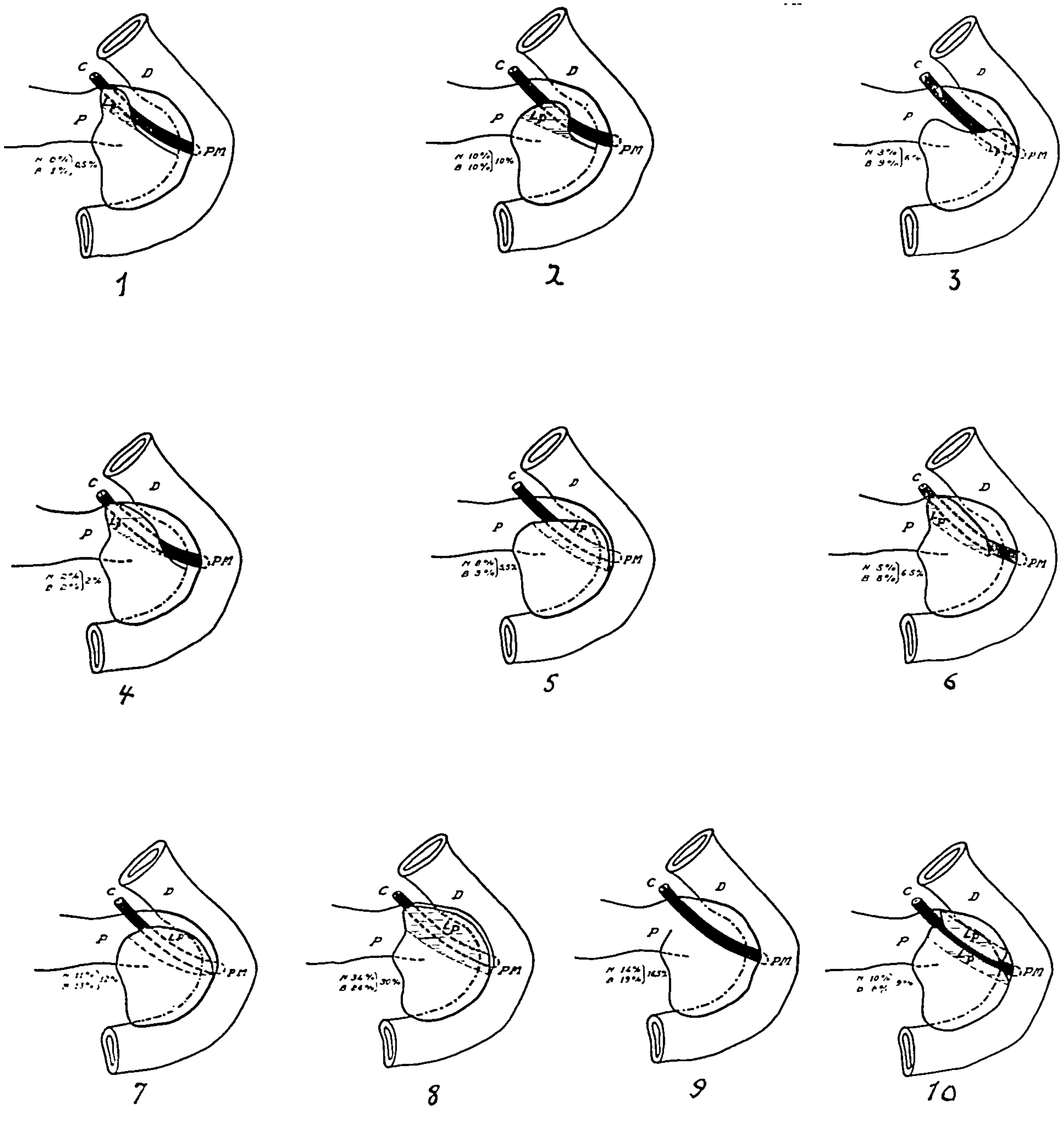

Fig. 1.—Diagrams of the dorsal face of the duodenum and of the pancreas head showing the "lingula" (*LP*). The number corresponds to the percentages in Negroes (*N*) and white subjects, (*B*). *PM*, major duodenal papilla; *D*, duodenum; *C*, choledochus and *P*, pancreas. *1*, "lingula" covering the proximal third of the choledochus in its pancreatic portion. (Group 1, subgroup 1). *2*, "lingula" covering the medium third of the choledochus in its pancreatic portion (Group 1, subgroup 2). *3*, "lingula" covering the distal third of the choledochus in its pancreatic portion (Group 1, subgroup 3). *4*, "lingula" covering the proximal half of the choledochus in its pancreatic portion (Group 1, subgroup 4). *5*, "lingula" covering the distal half of the choledochus in its pancreatic portion (Group 1, subgroup 5). *6*, "lingula" covering the proximal two-thirds of the choledochus in its pancreatic portion (Group 1, subgroup 6). *7*, "lingula" covering the distal two-thirds of the choledochus in its pancreatic portion (Group 1, subgroup 7). *8*, "lingula" covering the whole pancreatic portion of the choledochus (Group 2). *9*, tract of the choledochus in its pancreatic portion. Absence of the "lingula" (Group 3). *10*, two "lingulae," the upper with a cranial base and the lower with a caudal base (Group 4).

tering the duodenum, crossed the pancreatic substance and that in 5 per cent it passed laterally to the head of the gland.

Padula (1903), describing the course of the common duct, stated that it was placed between the duodenum and the head of the pancreas until it encountered the pancreatic duct, which it accompanied for a few millimeters.

Frequently the common duct, instead of running between the duodenum and the pancreatic head, dug into the latter a real groove. In other instances the biliary tract traversed the canal of that organ.

This author, who examined 165 cases, presented a diagram showing a section of the common duct and the three types of relations in the passage between the pancreas and the duodenum. No reference was made to the frequency of the 3 types.

Robinson (1907) presented 42 observations. The common duct was enclosed in the pancreatic tissue for a distance of ¾ inch (0.6 cm.). In 90 per cent of the cases it crossed the head of the pancreas obliquely, and was surrounded by pancreatic tissue, which rendered difficult its freeing by blunt dissection.

Ruge (1908) based his studies on 43 specimens. The common duct was observed twice on the posterior face of the pancreas; 4 times in a superficial groove of this face; 5 times in a deep groove difficult of dissection, and 32 times in complete pancreatic tissue. The difficulty of access to this portion of the common duct, owing to the anatomic dispositions mentioned and to the problem of hemostasis, as well as the danger of injuring the pancreatic duct, was stressed.

Baldwin (1911) described the relations of the common duct with the pancreas, stating that the former always ran caudally to the second portion of the duodenum and dorsally to the head of the pancreas, remaining in a very superficial furrow. The duct, to an extent of 0.5 to 5 cm., was completely surrounded by pancreatic tissue in 80 per cent of the cases. It was partially coated but not completely encircled by glandular tissue in 5 per cent of the cases, and in the remaining 15 per cent the biliary duct was observed in a furrow but not covered by pancreatic tissue. (No reference was made to the number of dissections.)

Belou (1915) studied 35 cases. The common duct in 14 cases (40 per cent) was in a furrow or sulcus, and in 12 cases (34 per cent) in an incomplete tunnel, which was thicker in the portion next to the parietal segment than in the portion adjoining the retroduodenal segment. In the upper part there was a furrow or sulcus, and in the lower part the duct became intrapancreatic. In 2 cases it seemed to be a complete tunnel. Touching the pancreatic tissue with a probe, however, sufficed to open the lips of the glandular groove which, behind the duct, can easily be separated. There was a complete tunnel in 9 cases (26 per cent). The pancreatic tissue behind the duct was thicker in the portion next to the intraparietal segment than in that next to the retroduodenum.

Maeda (1924) based his study on 60 cases. In only 1 instance was the retropancreatic common duct observed without a covering of pancreatic tissue.

Cameron (1924) studied 100 specimens with regard to the relations of the common duct with the pancreas. The common bile duct was within the pancreas head, surrounded by pancreatic tissue, in 69 per cent of the cases. In 31 per cent it was situated on the posterior surface of the gland in a fibrous furrow penetrating into the pancreas only in its terminal portion. Cameron's observations were compared with those of other investigators.

Fuchs, (1926) examined 50 adult cadavers by simple dissection and frozen cuts. He considered 4 main types and subordinated to these the forms of transition.

1. The common duct was observed to be oblique, with a slightly S-shaped course, in a shallow furrow directly attached to the pancreatic substance. This disposition was found in approximately one-fourth of the cases.

2. A layer of pancreatic tissue 3 to 5 mm. thick, covered the dorsal face of the common duct up to the posterior wall of the duodenum.

3. The variations of the previous type were considered under a separate group. For example, cases were found in which the common duct was entirely covered except in a small juxtaduodenal portion. In other cases a real groove was formed, covering half or three-quarters of the circumference of the duct.

Cases in which the complete canal was formed by the two lips of glandular substance united on the dorsal face of the common duct cut by loose conjunctive tissue, were described as variations.

4. This group included the cases in which the biliary tract perforated, axially, the pancreas head, surrounded on all sides by a layer of parenchyma 1 cm. thick. No cleavage plane was discovered in these cases.

Yamaguchi (1930) examined 140 cases, with the following results:

1. The pancreatic portion of the common duct was surrounded by the pancreatic substance in 120 cases. Two subgroups were established:

a. The entire pancreatic portion of the duct was surrounded (68 cases).

b. The greater part or only a small extension showed the involvement (53 cases). In these the distal end was more frequently covered, and was sometimes the medium or proximal one.

2. The internal half of the posterior face of the common duct or merely the internal border of this face was covered in 18 instances.

3. In 2 cases the posterior face of the common duct was totally uncovered.

Nuboer (1931), describing the extrahepatic portion of the biliary tract, pointed out that the common duct in its medium part was intimately connected with the pancreas. Of a total of 75 cases, the common duct was in a tunnel of pancreatic tissue in 50 cases (66.7 per cent). The part of the gland posterior to the duct was less thick than the anterior one. The duct was placed in a deep groove on the posterior face of the head of the pancreas in 20 cases (26.7 per cent). In these, nearly always, a small portion of the common duct, just above the duodenum, was completely covered by pancreatic tissue. In 2 cases (2.7 per cent) the duct was situated in a groove but covered on its posterior face by a small layer of pancreatic tissue. In 2 other cases (2.7 per cent) the duct was located in a groove on the anterior face of the pancreatic head. The duct was observed along the pancreas, with its terminal portion surrounded by the gland, in 1 case (1.3 per cent).

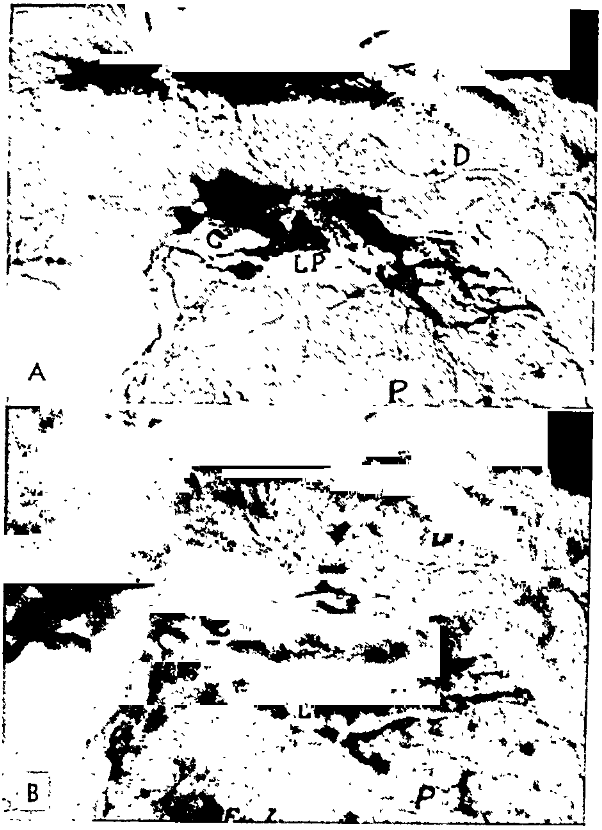

Fig. 2.—*A*, posterior view of the duodenopancreas. (V. R., male, 54 years old, white, Italian). The choledochus is covered by the pancreatic "lingula" in its medial third. *B*, same specimen. The pancreatic "lingula" shows the pancreatic portion of the choledochus.

Chlyvitch and Kozintzev (1937), in 100 dissected pancreases, observed 47 instances of supposed glandular canal covering the retropancreatic common duct in *its entire extension or merely in its distal* segment. The pancreatic groove that lodged the duct was in most cases posteriorly closed by lymphatic ganglia. Authors expressed the opinion that when the *nature of the tissue posteriorly closing* the pancreatic groove was unknown, the existence of the glandular canal should be admitted, and the frequency rates increased to approach those recorded by English or German authors. Concerning the cleavage plane, the presence of loose cellular tissue, showing on the posterior face of the pancreas the obliquity of the retropancreatic common duct, was admitted. It was more frequently related to the right border of the duct, rarely corresponding to the middle of the anterior face of the duct. It corresponded to the posterior face of the duct in 1 case. The cleavage plane sometimes presented resistant transverse bundles of connective tissue. These opposed the separation of the margins of the glandular canal. From the anatomic point of view there was no real canal in the distal portion of the common duct. So far as I know, these authors were the first to state that the choledochus duct was only apparently intrapancreatic.

Näätänen (1941), in a study of 100 cadavers, 49 female and 51 male, divided his results into 3 groups:

1. The common duct was observed in a slit on the dorsal surface of the pancreatic head, covered by connective tissue, in 53 per cent of the cases.

2. The common duct was observed on the dorsal surface of the pancreatic head, covered by a pancreatic "lingula," (34 per cent of the cases), with an extension of 5 to 50 mm. and a thickness of 2 to 5 mm. at most.

3. The common duct was close to the dorsal surface of the pancreas, in a tunnel of pancreatic tissue, in 12 per cent of the cases, the length of which ranged from 30 to 60 mm.

In 1 case the duct was observed on the ventral surface of the pancreatic head; this case was described in detail, and attention was called to its rarity.

*Finocchietto (1942) analyzed 100 cases* of dissection under surgical conditions. With reference to the relations between the choledochus duct and the pancreas head, the following results were obtained:

1. In a group of 11 cases the common duct presented its anterior face juxtaposed to a groove and its posterior face crossed by blood vessels and their branches in 5 cases. There was no pancreatic "lingula". The duct was entirely superficial, covered by the blade of Treitz and the pancreatic duodenal vessels, in 2 cases.

In 4 cases the duct elongated itself in a deep tunnel, its posterior face being covered by the blade of Treitz except in a small extension, where there was a delicate *pancreatic "lingula" covering a small* portion of the duct.

2. In a group of 15 cases, after removal of the Treitz' fascia, the choledochus remained invisible. In 3 cases the dissection showed that the duct ran in a very deep canal that gave the impression of a complete pancreatic tunnel. By placing the Béniqué probe through an opening of the retroduodenal segment of the duct and palpating it through the posterior face of the pancreas, the presence of a series of connective tracts and small vessels, passing in the form of a bridge over the duct, was verified. In order to isolate these it sufficed to withdraw the cellulovascular blade and separate the "lingulae".

*In 7 dissections the choledochus* appeared to be completely covered by glandular tissue; even after introduction of the Béniqué probe through the superduodenal orifice, no interstice could be seen. On the concave border of the second portion of the duodenum, 4 or 5 vascular duodenal-pancreatic branches passing from one organ to another were dissected and sectioned. By light manual pressure the posterior face of the pancreas head was opened, showing the common duct. The lips were united by
cellular tissue and b
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creatic furrow ended at the duodenal angle, where the superior duodenal pancreatic vessels crossed and generally a lymphatic ganglion was observed. In the lower portion the lips covered a superampullar portion of the common duct surrounded by dense connective tissue, numerous vessels and the opening of Wirsung's duct. The 5 remaining cases in this group were not described.

3. In a group of 74 cases the dissections showed an aspect termed "typical" by the author: after isolation of the duodenopancreas and separation of Treitz' blade a lymphatic choledochus ganglion was observed in the cephalic portion, and underneath it, the upper pancreatic-duodenal vessels. On separation and section of the upper pancreatic-duodenal trunks, it was possible to separate the "lingula" thus revealing a good portion of the common duct covered red by a layer of cellulovascular tissue. When pincers were placed along the posterior face of the duct and its branches were opened, the entire pancreatic duct, except a small portion of the superampullar (which remained covered, owing to condensation of the cellulovascular layer) was shown.

In only 5 of the total series of 100 cases was the pancreatic tissue detected at first glance, passing on a continuous bridge behind the posterior face of the duct. These were the 5 remaining cases of the second group.

To the anatomist, the author pointed out that the common duct ran along a depression of the posterior face in 11 per cent of the cases and along a canal in 89 per cent; to the surgeon, the fact that the canal could be easily transformed into a furrow by simple ligature and section of the pancreatic vessels between which the common duct is located, without section of the smaller portion of the gland. In 5 per cent it would have have been necessary to section the parenchyma only very slightly.

Leiva (1943) pointed out that the choledochus crossed the posterior face of the pancreatic head obliquely from top to bottom and from left to right, running through a canal or partial, tunnsel, or totally surrounded by glandular tissue. Of 100 observations, he observed a canal in 36, a tunnel in 56; a canal in the first half and a tunnel in the second half of the retropancreatic tract of the common duct in 8 cases.

Nogueira (1944) examined 31 fresh adult cadavers of different nationalities, mainly Brazilians, Negroes and mulattoes, observing that the pancreatic gland embraced the common duct in 26 of the 31 cases, by means of two "lingulae", of which the left was almost always more fully developed.

In 19 of these cases the approximation of the pancreatic "lingulae" was on the right border of the common duct, and practically only the left "lingula" covered the posterior face of the duct.

The approximation of the "lingulae" occurred on the posterior face of the common duct, being therefore covered by the two "lingulae", in 7 instances.

In 5 cases the common duct was observed along a simple furrow; that is, there were no "lingulae," and the duct was reached by section of Treitz' fascia; in 1 of these cases the furrow was observed along the lateral border of the pancreatic head next to the duodenum.

No case of a real canal was observed and no junction of the "lingulae" on the left border of the anterior face of the common duct was recorded.

The retropancreatic common duct, was not covered by pancreatic parenchyma in 16 per cent of the cases.

In the remaining cases (84 per cent) the pancreatic portion of the duct was enclosed in a groove of pancreatic tissue presenting a cleavage plane which, after the duodenal-pancreatic mobilization, exposed the common duct without injuring the glandular parenchyma.

Degni (1945) referring to the length of the pancreatic segment of the common duct, pointed out that for measuring purposes two portions were considered with reserve: the retropancre-

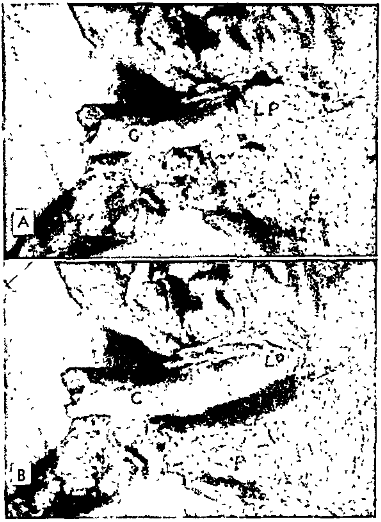

Fig. 3.—*A*, dorsal view of the duodenopancreas (J. D., a Brazilian Negro 85 years old). The choledochus and the small pancreatic "lingula" are seen covering the distal third. *B*, same specimen. The pancreatic "lingula" shows the entire *pancreatic portion of the choledochus.*

atic and the "intrapancreatic." As to the intrapancreatic variety, he admitted two possibilities resulting from the relations of the common duct, with the pancreatic "lingulae", namely, the complete and the incomplete tunnel. In the first instance the "lingulae" completely covered the choledochus duct from behind, with the exception of the blade corresponding to the cleavage plane. In the second instance the *intrapancreatic segment of the duct* was covered incompletely by the pancreatic "lingula". Another disposition was pointed out when the duct was between the duodenal margin of the pancreatic head and the duodenum (called interpancreatic-duodenal).

In Degni's work the following variations were observed in 55 cases:

1. There were 31 cases (86.4 per cent) in which the common duct was partly "intrapancreatic" and partly retropancreatic. In 10 cases (18.2 per cent) the duct was entirely intrapancreatic, forming an incomplete tunnel in 4 cases and a complete one in 6. In 7 cases (12.7 per cent) the duct was totally retropancreatic. In 4 cases (7.2 per cent) the duct was predominantly or totally interpancreatic-duodenal. In 2 cases (3.6 per cent) the duct was totally prepancreatic. In 1 case (1.8 per cent) the duct was retropancreatic (predominantly) and interpancreatic-duodenal.

With regard to the connections of the common duct (or the hepatic duct) with its pancreatic bed, the presence of the cleavage plane that allowed access to the biliary tract was studied. It was verified that this connection was loosened by connective tissue, which also joined the "lingulae" to each other or the "lingulae" to the pancreas behind the choledochus, thereby constituting the cleavage plane.

The duct was easily detachable from its bed, owing to the nature of the union. In addition to loose connective tissue, blood vessels were observed. In cases in which the common duct was totally or partially "intrapancreatic," a cleavage plane leading to that canal was always found. Therefore, it was always *apparently* intrapancreatic, since in all cases there was a connective septum indicating that the duct was not really intraglandular.

In reference to the small retrocholedochus pancreatic "lingulae," 75 cases were studied in detail, described and illustrated. The length of the common duct covered by eventual "lingulae" was noted. In 12 observations (16 per cent) there were 2 "lingulae," one with a left lateral caudal base and the other with a right lateral base, related to the common duct; the latter were always less well developed than the former, except in 1 case, in which the "lingula" of the right lateral base was only 1 "lingula" with a left caudal lateral base (70.7 per cent). Therefore, in 65 of the 75 observations (86.6 per cent) one or two "lingulae" covered the pancreatic segment of the common duct, showing a supposed glandular canal. In 20 of these cases the thickness and length of the "lingula" were studied in detail.

Freitas (1948) examined 100 cadavers, 64 male (28 white and 36 Negro) and 36 female (10 white and 26 Negro) in order to study the duodenum and its relations with the neighboring organs. Referring to the common duct, he pointed out that: "The choledochus penetrates into the pancreas, has a variable course in all the intrapancreatic extension with a single opening into the duodenum. On all cases examined we observed that the choledochus always ends with the pancreatic canals at the right angle formed by the lower or distal extremity of the second portion of the duodenum with the proximate extremity of the third."

In a second research (1950), he included 40 other dissections made on 28 male cadavers (9 white and 19 Negro) and 12 female cadavers (5 white and 7 Negro), confirming his previous observations.

Sterling (1949) dissected 80 specimens, pointing out that the common biliary duct on crossing the pancreas frequently became narrowed.

In 16 of 49 cases (32.6 per cent) the extraduodenal distal portion of the common biliary duct was extrapancreatic. In 15 cases (30.6 per cent) the duct was totally intrapancreatic, and in the remaining 18 cases (36.8 per cent) it was partially intrapancreatic.

Bustos (1951) referred to studies made in 1933 on 54 cadavers, the originals of which I was unable to obtain. Bustos pointed out that the descriptions found in classic books should not be considered to represent the normal and or even the most common disposition.

The choledochus was observed in a pancreatic canal in 30 per cent of the cases; in 18 per cent the tunnel was very short, existing only close to the duodenal wall. In 9 per cent the choledochus ended very high, close to the first portion of the duodenum, or even in the first portion, touching tangentially the head of the pancreas. Therefore, in 45 per cent of the cases the most frequent disposition was that which could be termed duodenal interpancreatic, in which the common duct runs over the dihedrom angle formed by the head of the pancreas and the duodenum.

Taking all cases into consideration, 84 per cent did not show the common duct covered by pancreatic tissue.

The end point of the common duct in the duodenum, with or without the ampulla of Vater, was variable. In addition to its most common ending (in the second portion of the duodenum) the choledochus sometimes opened in the first or in the third portion, crossing the entire posterior face of the pancreas close to the surface or in a smooth canal, always covered by Treitz's blade.

*Comment.*—Initially I wish to stress the fact that the diversity in the frequency of types recorded by the different researchers was conditioned by various factors, mainly the variety of the methods of study, the difference in orientation of the observations and criteria of research, which in most cases were sufficiently described to serve as a basis or in comparison with later studies. The different numbers of observations, some being very small, studied by certain authors, may be seen by the following list, was also doubtless one reason for the conflicting results: (Wyss, 22 cases; Helly, 40; Letulle and Nathan Larrier, 19; Wiart, 10; Büngner, 58; Padula, 165; Robinson, 42; Ruge, 43; Baldwin, (?); Belou, 35; Maeda, 60; Cameron, 100; Fuchs, 50; Yamaguchi, 140; Nuboer, 75; Chlyvitch and Kozintzev, 100; Näätänen, 100; Finochietto, 100; Leiva, 100; Nogueira, 31; Degni, 75; Freitas, 140; Sterling, 80, and Bustos, 54).

On the other hand, the data are divided into two groups: (a) studies made carelessly, with no description of types or of variations in the "lingula" and no reference to the identification of the material, and (b) more detailed works classifying the different types of "lingulae" observed and reuniting them in distinct groups, some identifying the studied material.

There was no consistency as to the manner of grouping the pancreatic "lingulae" into types and subtypes in reference to the extent to which they covered the choledochus.

The majority did not even refer to "double lingula," one caudal and the other cranial. With few exceptions, the portion of the choledochus covered by the "lingulae" was not placed in an outstanding position. No consideration was given to the portion covered merely by lymphatic ganglia, arteries, veins and peritoneal coalescence blade. It was not mentioned which of the two portions was the larger, a point of practical interest. In this respect Degni's work stands out.

Concerning the anatomy textbooks, I forego a revision in this respect, since they summarily describe the relations of the choledochus with the pancreas in a neccessarily abritrary manner, not on the basis of proper researches in series.

From the foregoing comments it would seem, further, that a study of more abundant material of different ethnic values would be fitting.

*Material of Present Study.*—My material consisted of 200 autopsy specimens from the Department of Pathological Anatomy of the Medical School of the University of São Paulo, duly identified, 100 being white and 100 Negro, more or less pure in breed according to the essential somatoscopic characteristics (in Brazil, we are unable to speak of "pure" Negroes). Among the whites there were 75 male and 25 female subjects; 67 were Brazilian, 17 Italian, 5 Spanish, 4 Portuguese, 3 German, 2 Libanese, 1 Czchecoslovak and 1 Lithuanian. Among the Negro subjects there were 59 male and 41 female specimens; 99 were Brazilian and 1 South African. Adults predominated.

The specimens were collected in two ways: 1. I was present at the autopsy, and after the organs were examined I received those in which I was interested. These comprised the duodenum, the pancreas, part of the stomach, elements of the hepatic pedicle, the mesocolon and the mesenteric roots. The specimens were numbered and preserved in formaline solution of formaldehyde. 2. After the autopsy the specimens were studied by other researchers of the Department of Descriptive and Topographic Anatomy, whose studies were related to the stomach, liver or gastroduodenal pylorus. After they had been used for these researches they were numbered and preserved in solution of formaldehyde for this study.

I recorded the number and identity of

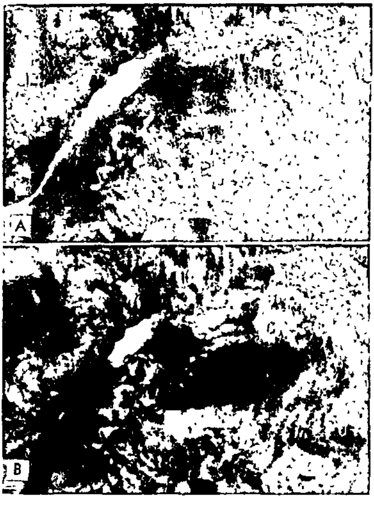

Fig. 4.—*A*, dorsal view of the duodenopancre
(C. R., a Brazilian Negro 54 years old).
choledochus is covered in its proximal half
pancreatic "lingula." *B*, same specimen.
pancreatic "lingula" shows the entire pancr
portion of the ochus.

each specimen on a registry card.

*Method.*—The specimen, after it was fixed in solution of 10 per cent formaldehyde, was reduced, with retention of the pancreas, the duodenum, some centimeters of the gastric antrum, the choledochus and the cystic duct when the latter joined the biliary duct at a low level. The body and tail of the pancreas, as sectioned during the autopsy, were not included in some specimens. The preparations used in other previous studies had not included the pylorus and the gastric antrum.

A preestablished plan was followed, with the purpose of securing the maximum knowledge from the material by isolating and observing all the elements that served as a basis to this and other works.

The dissection was started at the posterior face of the head of the pancreas in order to identify the pancreatic "lingulae," in relation to the pancreatic segment of the choledochus. I isolated, when present, the arteries, the veins and the lymphatic ganglia, and freed the posterior surface of the pancreatic head from the coalescence peritoneal membrane, seeking the cleavage plane formed by the loose connective tissue that joins the free border of the pancreatic "lingula" to the posterior face of the cranial portion of the pancreatic head. The "lingula" was carefully dissected with fine scissors. Divulsion maneuvers were made through the loose connective tissue existing in this region until I reached the choledochus, which was not withdrawn from its bed. A diagram was made, recording the conformation of the "lingula" when it existed, showing the portion of the choledochus covered by it.

*Results.*—My observations were gathered in five groups in decreasing order of frequency, among which some presented subgroups, and to these I subordinated the forms of transition. I divided the material as follows

1. Presence or absence of the "lingula."
2. When the "lingula" existed whether it was single or "double" (2 "lingulae").
3. In both cases, whether it covered totally or partially the pancreatic portion of the choledochus.
4. In the latter instance, to what extension and level the choledochus was covered by the "lingula."

Finally, I considered a group that included all instances of less frequent morphologic aspects.

To understand the term "pancreatic lingulae" it is necessary to remember that I considered these present only when there was juxtaposition of their free borders with the remainder of the pancreatic head or when there was juxtaposition of the free borders of the two "lingulae," there existing always, of course, an interposed laminar connective septum. If direct juxtaposition was lacking and this space between the borders was filled with connective tissue, I considered it an instance of the choledochus located in the furrow of the posterior face of the pancreatic head.

The frequency of the different types of pancreatic "lingulae" in whites and Negroes of both sexes was verified. As the number of whites and Negroes was equal (100 each), the frequency of each type would also be the percentage for whites and Negroes.

The first group included the cases of unique pancreatic "lingula" of caudal base and variable extension, partially covering the choledochus. It was observed *in 39 Negroes and 46 white subjects, making* 42.5 per cent of the total.

This group was divided into seven subgroups according to the extension of the pancreatic portion of the choledochus covered by the "lingula."

1. The pancreatic "lingula" covered only the proximal third of the pancreatic portion of the choledochus. This was observed in a white subject.

2. The pancreatic "lingula" covered the *medial third of the pancreatic portion of* the common duct. This subgroup included

10 Negroes and 10 whites.

3. The pancreatic "lingula" covered merely the distal third of the pancreatic portion of the choledochus. This was found in 3 Negroes and 9 whites.

4. The pancreatic "lingula" covered the proximal half of the pancreatic portion of the choledochus. This ocurred in 2 whites.

5. The pancreatic "lingula" covered the distal half of the pancreatic portion of the choledochus. This was seen in 8 Negroes and 3 whites.

6. The pancreatic "lingula" covered the two proximal thirds of the pancreatic portion of the choledochus. This was found in 5 Negroes and 8 whites.

7. The pancreatic "lingula" covered the two distal thirds of the pancreatic portion of the choledochus. This was found in 11 Negro and 13 white specimens.

The second group comprises the cases of unique pancreatic "lingula" with a caudal base, covering the entire pancreatic portion of the choledochus. This was observed in 34 Negro and 26 white specimens, 30 per cent of the total.

The third group comprises the cases in which no pancreatic "lingula" was present. The pancreatic portion of the choledochus was merely juxtaposed to the posterior face of the head of the pancreas and was fixed thereto by means of a coalescent membrane with venous, arterial and lymphatic elements. This was observed in 13 Negro and 17 white specimens. In 1 Negro and 2 white specimens there was a slight trace of a groove. This group corresponded to 16.5 per cent of the total.

In the fourth group are included cases of double "lingula"; an upper one with a cranial base and a lower one with a caudal base, always juxtaposed by their free border. This was observed in 10 Negro and 8 white specimens, making 8 per cent of the total. This group was subdivided into two subgroups

1. The "lingulae" covered the pancreatic portion of the choledochus in all its extension in 4 Negro and 2 white specimens.

2. The "lingulae" partially covered the pancreatic portion of the choledochus and were of varying extent in 6 Negro and 6 white specimens.

The fifth group included less frequent morphologic variations. This was observed in 4 cases, 2 per cent of the total. In 2 Negro and 1 white specimen, in addition to dissecting the "lingula," it was necessary to section the pancreatic tissue to a small extent to obtain complete freedom of the choledochus.

Only by previous histologic examination, however, would it be possible to evaluate this tissue, in lieu of a real absence of the cleavage plane.

In 1 Negro specimen the choledochus presented was prepancreatic, lodged in a groove covered by conjunctive tissue and therefore dissectable through the anterior face of the head of the pancreas.

*Sex Incidence*: In relation to sex, my observations were as follows: The first group includes the single pancreatic "lingula" with a caudal base and variable extent, partially covering the choledochus. This was present in 56 male specimens (33 white and 23 Negro) and 29 female specimens (13 white and 16 Negro).

In the first subgroup there were no male specimens and only one female (white); in the second, 13 male specimens (6 white and 7 Negro) and 7 female specimens (4 white and 3 Negro); in the third, 6 male specimens (all Negro) and 6 female specimens (3 white and 3 Negro); in the fourth, 4 male specimens (2 white and 2 Negro) and no female specimens; in the fifth, 5 male specimens (1 white and 4 Negro) and 6 female specimens (2 white and 2 Negro); in the sixth, 9 male specimens (7 white and 2 Negro) and 4 female specimens (1 white and 3 Negro), and in the seventh, 19 male mens (11 white and 8 Negro) and 5 specimens (2 white and 3 Negro).

In the second group [illegible] ue [illegible] gula" with a caudal ing the retropancreatic portion of the choledochus duct was present. There were 42 male specimens (21 white and 21 Negro) and 18 female specimens (5 white and 13 Negro).

In the third group the "lingula" was absent. There were 22 male specimens (15 white and 7 Negro) and 11 female specimens (4 white and 7 Negro).

In the fourth group the double "lingula" was present. There were 11 male specimens (5 white and 6 Negro) and 7 female specimens (3 white and 4 Negro).

In the fifth there were less frequent morphologic variations. There were 3 male specimens (1 white and 2 Negro) and 1 female specimen, Negro.

*Results.*—From an analysis of these observations it is verified that the pancreatic "lingula" is a very frequent anatomic formation, having occurred in 83 per cent of the cases.

The "lingula" had a variable development. All types of transition, from the slightest projection covering a small segment of the choledochus (42.5 per cent) to the most highly developed type, completely covering its retropancreatic portion (30 per cent), were observed.

These are the cases in which the choledochus is apparently intrapancreatic, as it is totally surrounded by glandular tissue. The isolation of the "lingula" is difficult, even on the fixed anatomic specimen, since its free border has a varied localization. It may coincide with the upper border of the head of the pancreas, therefore, far from the choledochus, and also because the "lingula" in these cases is thick. Some researchers considered this situation merely intrapancreatic.

In the greater number of types observed, constituting the first group, the "lingula" had a larger or smaller development, partially covering the pancreatic portion of the choledochus duct (42.5 per cent of the total). The "lingula" had varied extensions. For a better understanding, it was necessary to divide it into seven subgroups, into which the transition types were included.

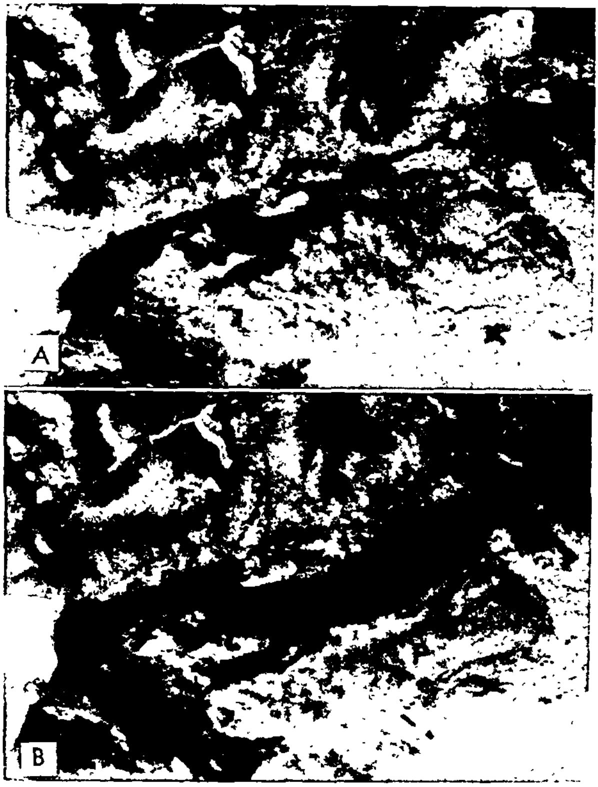

Fig. 5.—*A*, dorsal view of the duodenopancreas (F. M. C., a white Brazilian woman 55 years old). The pancreatic choledochus is seen in its proximal half; the distal half is covered by the pancreatic "lingula." *B*, same specimen. The pancreatic "lingula" shows the choledochus in its entire pancreatic portion.

Absence of the "lingula" was observed in 16.5 per cent of the cases. In these the choledochus was easily exposed, covered merely by lymphatic ganglia, arteries, veins and peritoneal coalescence membrane, which permitted its access without damaging the pancreatic tissue.

The fourth group included the cases of a double "lingula." The dissection of these was very easy, as the "lingulae" were slender and juxtaposed on the posterior face of the choledochus. This type was observed in 9 per cent.

In the fifth group were included less frequent morphologic variations, which were observed in 4 cases, or 2 per cent of the total. In 3 cases, in addition to the "lingula," there was a slender bridge of pancreatic tissue over the choledochus, which was sectioned to free it completely.

TABLE 1.—*Statistics on Negro Subjects*

| *Group* | *Male* | *%* | *Female* | *%* | *Total* | |
|---|---|---|---|---|---|---|
| I | ........23 | 23 | 16 | 16 | 39 | 39%±4.96 |
| II | ......21 | 21 | 13 | 13 | 34 | 34%±4.73 |
| III | .... 7 | 7 | 7 | 7 | 14 | 14%±3.46 |
| IV | .... 6 | 6 | 4 | 4 | 10 | 10%±3 |
| V | ...... 2 | 2 | 1 | 0 | 3 | 3%±1.70 |

TABLE 2.—*Statistics on White Subjects*

| *Group* | *Male* | *%* | *Female* | *%* | *Total* | |
|---|---|---|---|---|---|---|
| I | ........23 | 33 | 13 | 13 | 46 | 46%±4.98 |
| II | ......21 | 21 | 5 | 5 | 26 | 26%±4.38 |
| III | ....15 | 15 | 4 | 4 | 19 | 19%±3.92 |
| IV | .... 5 | 5 | 3 | 3 | 8 | 8±%2.71 |
| V | ...... 1 | 1 | 0 | 0 | 1 | 1±%0.99 |

Macroscopically, the impression was that of continuity of the pancreatic tissue.

The choledochus in a prepancreatic position is rare. It was observed in only 1 case (0.5 per cent). The duct with its normal caliber reached the duodenum by the inferior face of the pancreas head lodged in a groove, covered only by loose connective tissue, blood vessels and peritoneal membrane. Owing to the special prepancreatic position of the choledochus, this observation was excluded from the general computation of data on the absence of the "lingula" which refer to the dorsal face of the head of the pancreas.

*Cleavage Plane*: The dissection plane between the free border of the "lingula" and the posterior face of the head of the pancreas, giving access to the retropancreatic portion of the choledochus duct was observed in 100 per cent of the cases in which "lingula" were present.

Its identification presented [illegible] only when the pancreatic "lingula" [illegible] unique and covered the [illegible] creatic choledochus, [illegible] of the cases, in which the [illegible] the "lingula" [illegible] with the upper [illegible] head. Aside from these cases, its discovery and the research on the specimens were very easy, especially when only the distal portion of the choledochus was covered. In the cases of double "lingulae" the borders of both, generally, juxtaposed themselves on the posterior face of the choledochus, and the simple maneuver of divulsion introduced by Degni sufficed to show the entire choledochus.

In 3 cases it was necessary to section a small extension of the pancreatic tissue so as to free the choledochus completely. The cleavage plane in all 3 cases was perfectly identified and the "lingula" freed. Glandular tissue was present; its continuity, in the process of dissection, was interrupted.

### COMMENT

In order to compare these results with those of other authors, their cases were grouped according to the five types here presented. This was not always possible, either because of inaccurate description in some studies, or because of the fact that the authors did not record the five types.

With regard to the first group, which comprises the choledochus partially covered by the "lingula" and present in 42.5 per cent of the cases, Helly noted it in 45 per cent of his 40 observations, and Letulle and Nathan-Larrier in 42.1 per cent (8 of 19 observations). They [illegible] the number of cases. Yamaguchi verified, in his 100 dissections, 34 cases (34 per cent) belonging to the first type. Finochietto observed 78 cases that could be included in the first group (78 per cent). According to Leiva, the "lingula" partially covered the duct in 8 per cent of cases. Some approximate those here presented, aside from a great difference in percentages, which probably can be attributed to diversity of opinion in observation.

In relation to my Type 2, in which the choledochus is totally covered by the unique pancreatic "lingula" with a caudal base, which was verified in my material in 30 per cent of the cases, Helly noted it in 17.5 per cent of his 40 cases. Belou observed a complete tunnel in 9 cases (26 per cent). Yamaguchi observed the entire retropancreatic portion to be covered in 68 cases (48.5 per cent). Nuboer referred to 50 cases (66.7 per cent). Näätänen recorded 12 cases of this type (12 per cent). Finochietto classified 10 cases (10 per cent) in this group. Leiva described the "lingula" as entirely covering the choledochus in 56 per cent of cases.

Some authors listed in a single group the cases that correspond to those in my first and second groups, giving the total results.

Chlyvitch and Kozintzev reported a supposed glandular canal surrounding the entire retropancreatic portion of the choledochus, or only its distal segment, in 57 cases (57 per cent). Nogueira observed the pancreatic "lingula" partially or totally covering the choledochus in 19 cases (64.2 per cent). The pancreatic "lingula" partially or totally covered the pancreatic portion of the choledochus in 53 cases (70.7 per cent), according to Degni. On addition of my results in the first and second groups, 30 per cent plus 42.5 per cent, I arrive at 72.5 per cent, a result corresponding to Degni's.

Type 3 includes the cases in which the choledochus was entirely retropancreatic, merely juxtaposed to the posterior wall of the head of the pancreas and affixed thereto by the peritoneal coalescene membrane with lymphatic, arterial and venous elements, which I observed in 16.5 per cent, Helly observed it in 37.5 per cent of his cases; Letulle and Nathan-Larrier in 57.8 per cent (11 of 19 cases). Büngner recorded 3 cases, or 5.1 per cent. Padula admitted the existence of this type. Belou verified a furrow or groove in 14 cases (40 per cent). Maeda mentioned only 1 case in 60 dissections (1.6 per cent). Yamaguchi proved the absence of the "lingula" in 2 cases (1.4 per cent). He considered as a separate group that in which the "lingula" covered only the internal half or the internal border of the duct, observed in 18 cases (12.8 per cent) which I included in my third group. Näätänen verified the absence of the "lingula" in 53 cases (53 per cent); Finochietto in 7 cases (7 per cent) and Leiva in 36 cases (36 per cent). Among the local authors, Nogueira verified the absence of the "lingula" in 5 cases (16.1 per cent) and Degni in 75 observations, 10 cases (13.3 per cent). My result, 9 per cent, corresponds to those of Finochietto and closely approximate those Nogueira and Degni.

It is worth mentioning that since there

TABLE 3.—*Incidence in Male Subjects*

| *Group* | *Negro 59* | | *White 75* | | *Total 134* | |
|---|---|---|---|---|---|---|
| I | ......23 | 38.9% | 33 | 44.0% | 56 | 41.7%±5.90 |
| II | ....21 | 35.5% | 21 | 28.0% | 42 | 31.3%±4.89 |
| III | .... 7 | 11.8% | 15 | 20.0% | 22 | 16.4%±3.79 |
| IV | .... 6 | 10.1% | 5 | 6.6% | 11 | 8.2%±2.77 |
| V | .... 2 | 3.3% | 1 | 1.3% | 3 | 2.2%±1.46 |

TABLE 4.—*Incidence in Female Subjects*

| *Group* | *Negro 41* | | *White 25* | | *Total 66* | |
|---|---|---|---|---|---|---|
| I | ......16 | 39.0% | 13 | 52% | 29 | 43.9%±3.83 |
| II | ..13 | 31.7% | 5 | 20% | 18 | 27.2%±3.99 |
| III | .... 7 | 17.0% | 4 | 16% | 11 | 16.6%±3.52 |
| IV | 4 | 9.7% | 3 | 12% | 7 | 10.6%±3.69 |
| V | . 1 | 2.4% | 0 | 0% | 1 | 1.5%±1.20 |

is no uniform criterion for identifying the "lingula," its presence or absence depends a great deal upon the observer's personal way of considering it.

The fourth group has no outstanding position with the majority of researchers, and only Fuchs, among foreign authors has referred to it, considering it a subgroup. Helly, Letulle and Nathan-Larrier, Näätänen, Yamaguchi, Finochietto and others who described similar material in some detail did not record the presence of this variety. The same is not true of the local researchers. Nogueira observed 2 "lingulae" in 7 cases (22.5 per cent) and Degni in 12 cases (16 per cent). In my own material I observed 18 cases, totaling 9 per cent. As compared with those given by the aforementioned authors, the percentages are not in agreement.

Under Type 5 I collected the cases in which there were less frequent morphologic variations.

I observed the prepancreatic choledochus only once (0.5 per cent). Näätänen described 1 case out of 100 and Nuboer 2 cases (2.7 per cent). Chlyvitch and Kozintzev mentioned 1 case. Degni recorded 2 cases (3.6 per cent).

In this group I also included 3 cases (1.5 per cent) in which, besides the dissectable pancreatic "lingula," it was necessary to resect a small part of the pancreatic tissue in order to free the choledochus completely.

Finochietto claimed that it was necessary to section the pancreatic tissue to free the choledochus in 5 cases.

In order to facilitate comparative study on the frequency of the types of pancreatic "lingulae" in Negro and white persons, I presented tables of statistical percentages and corrections of the results previously referred to. It is to be noted that, in the total results of the group, there is no difference of any statistical value.

The variations in the frequency of types of pancreatic "lingulae" in both sexes enabled me to compile the following table, in which it is apparent that the total values for the different groups are very close, there being no sufficient statistical difference to be significant.

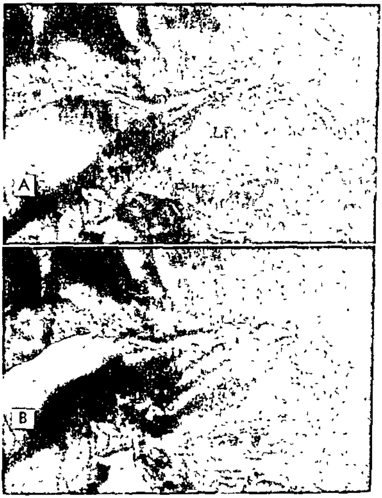

Fig. 6.—*A*, dorsal view of the duodenopancreas (A. J. C., a Brazilian white man 26 years old). The pancreatic portion of the choledochus is covered in its proximal two-thirds. *B*, same specimen. The pancreatic "lingula" shows the entire pancreatic portion of the choledochus.

In order to verify the statistical value of the differences in percentage of the various groups of pancreatic "lingula" in Negroes and white persons, and in both sexes, I proceeded to calculate the standard error in the difference of these percentages.*

For this comparison I merely considered Group 2, in which the percentage difference between Negroes and white persons was greater.

This difference (8) was 1.25 times greater than the standard error (6.4 per cent). It was therefore within the fluctuation limits of the sample and may be considered at random.

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*Formula $E_{12} = \frac{\quad}{\sqrt{p_0 \cdot q_0 \cdot (1/n_1 + 1/n_2)}}$

With regard to sex distribution, I also considered Group 2, in which the difference in percentages was greater. This difference (4.1 per cent) was 0.60 times smaller than the standard error (6.8 per cent). It was therefore within the fluctuation limits of the sample, and may be considered at random.

Dissection of the choledochus in its pancreatic portion presents no difficulty when there is no pancreatic "lingula," as the duct is juxtaposed to the posterior face of the head of pancreas or placed in a more or less deep furrow.

When there is a pancreatic "lingula," however, dissection is more difficult and arduous, requiring careful tactics and highly technical maneuvers. These were suggested, studied and described by Degni in his thesis.

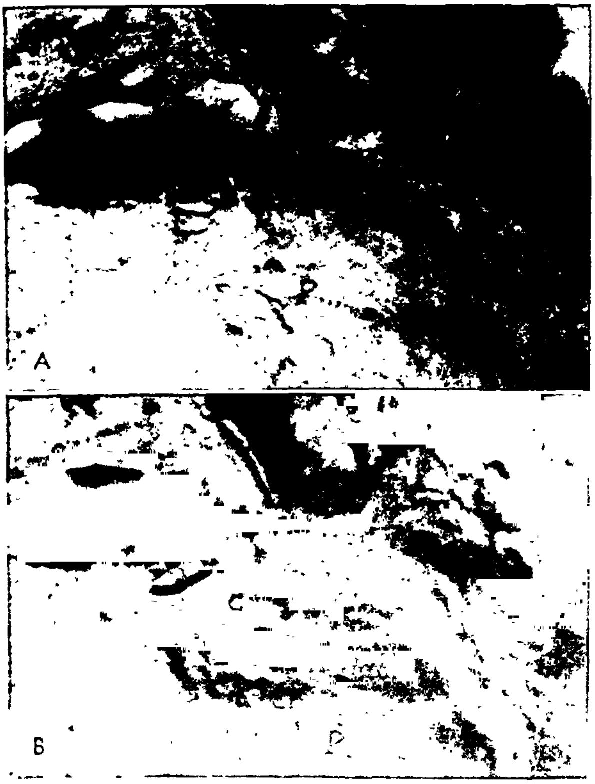

Fig. 7.—*A*, dorsal view of the duodenopancreas (M. A. S., a white Brazilian woman 77 years old). The choledochus is completely covered by the pancreatic "lingula." *B*, same specimen. The "lingula" shows the entire pancreatic portion of the duct.

In this second group, from the point of view of dissection, in practical application, one can establish two subgroups: 1. Cases in which the proximal part of the pancreatic portion of the choledochus is not covered by the pancreatic "lingula" but rather by loose conjunctive tissue easily permitting dissection directly over the choledochus; farther along, when one finds the pancreatic "lingula," the divulsion maneuver is used. 2. Cases in which the choledochus seems to penetrate the head of the pancreas. Its pancreatic portion is all or almost all surrounded by pancreatic tissue, sometimes of considerable thickness. The cleavage plane permits freeing of the small pancreatic "lingula," but its discovery even in the anatomic specimen is difficult, arduous and long; to my way of thinking, in this subgroup are included the cases unfavorable to the use of the divulsion method, or any other method so far known, in exposing the pancreatic portion of the choledochus. In view of these facts, a subdivision can be established for the cases with "lingulae" as favorable or unfavorable for the dissection of this portion of the choledochus, with the following frequency: adding up the cases in which the pancreatic "lingula" covered the choledochus duct only in its medial (20 cases) or distal (12 cases) portion, those in which it covered the entire of distal half (11 cases) and still covered the distal two-thirds (24 cases, or 12 per cent), one has 33.5 per cent, which, added to the 16.5 per cent of the group with no pancreatic "lingula," makes 50 per cent of the total. Therefore, in 50 per cent of the cases the choledochus is not covered by pancreatic tissue or is only partially so, at the most up to its distal two-thirds.

To this group one may add the fourth group, that is, the cases with two pancreatic "lingulae," inasmuch as the lips of both are juxtaposed at the level of the posterior face of the duct, either cranially

2. The absence of the "lingula" was verified in 16.5 per cent of the cases.

3. The prepancreatic choledochus is rare. It was observed in 0.5 per cent of the cases (1 observation in 200).

4. In all cases of pancreatic "lingula" there was a cleavage plane which permitted freeing it.

5. Practically, in 60 per cent of the cases, the choledochus in its retropancreatic portion was easily accessible, either because it was not covered by pancreatic tissue or was covered, only to a small extent, or was covered by two "lingulae," the lips of which were juxtaposed at the level of the posterior face of the duct.

6. In 40 per cent of the cases the "lingula" was thick. It covered the duct entirely (30 per cent of the cases), or in its proximal half. Under these conditions the isolation of the choledochus is very difficult.

7. The variations observed with reference to the two ethnic groups, Negro and white, and to the two sexes, presented no significant statistical differences.

## SUMMARY

With the use of autopsy material, the pancreatic "lingulae" related to the choledochus were dissected in 100 white specimens (75 male and 25 female) and 100 Negro specimens (59 male and 41 female), of more or less pure racial strains as classified by the essential somatoscopic characters.

The specimens were fixed in 10 per cent solution of formaldehyde.

The observations are presented in five groups in decreasing order of frequency, some with subgroups, to which the transitional forms were subordinated.

Group 1: Cases of unique pancreatic "lingula" of caudal base and variable extension, partially covering the choledochus. This was observed in 39 Negro specimens (23 male and 16 female) and 46 white specimens (33 male and 13 female), 42.5 per cent of the total number.

Group 2: Cases of unique pancreatic "lingula" of the caudal base covering the entire pancreatic portion of the choledochus. This was observed in 34 Negro specimens (21 male and 13 female) and 26 white specimens (21 male and 5 female), 30 per cent of the total.

Group 3: Cases in which there was no pancreatic "lingula". The pancreatic "lingula" of the choledochus was merely juxtaposed to the posterior face of the head of the pancreas and adhered thereto by means of a coalescent membrane containing lymphatic, arterial and venous elements. It was observed in 14 Negro specimens (7 male and 7 female) and 19 white specimens (15 male and 4 female), 16.5 per cent of the total.

Group 4: Cases of double "lingula"; an upper one at the cranial base and a lower one at the caudal base, always juxtaposed to the free border. It was observed in 10 Negro specimens (6 male and 4 female) and 8 white specimens (5 male and 3 female), 9 per cent of the total.

Group 5: Cases in which there were less frequent morphologic variations. The subjects included 3 Negro and 1 white specimen—2 per cent of the total.

From the analysis of his results the author draws the following conclusions:

1. The small solitary or "double" pancreatic "lingula" on the posterior face of the head of the pancreas, partially or totally covering the pancreatic portion of the choledochus, is a frequent formation, having been observed in 83 per cent of the cases.

2. Absence of the "lingula" was verified in 16.5 per cent of the cases.

3. The prepancreatic choledochus is a rare anomaly. It was present in 0.5 per cent of the cases (one in 200).

4. In all cases of pancreatic "lingula" there was cleavage plane that permitted freeing it.

5. In virtually 60 per cent of the cases the choledochus in its retropancreatic portion is easily accessible, either because it

is not covered by pancreatic tissue or is so covered only in a small portion of its length, or because it is covered by two "lingulae", the lips of which are juxtaposed the level of the posterior face of the duct.

6. In 40 per cent of the cases the "lingula" is thick. It covers the duct entirely (30 per cent), in its proximal two-thirds or its proximal half. Under these conditions the isolation of the choledochus is made very difficult.

7. The variations observed with reference to the two ethnic groups and the two sexes provided no significant statistical variations.

## ZUSAMMENFASSUNG

Die "Lingula" der Bauchspeicheldrüse und ihre Beziehung zum Ductus choledochus wurde an einem Sektionsmaterial von 100 Weissen (75 Männer und 25 Frauen) und 100 Negern (59 Männer and 41 Frauen) präpariert. Die Leichen waren nach Klassifizierung auf Grund der wesentlichen somatoskopischen Merkmale mehr oder weniger rasserein.

Die Präparate wurden in 10-prozentiger Formalinlösung fixiert.

Die gwonnenen Beobachtungen werden in fünf Gruppen nach Häufigkeit eingeteilt. Einige davon haben Unterbteilungen, in welche die Übergangsformen eingeordnet sind.

Gruppe 1: Fälle mit einer einzigen "Lingula" mit kaudaler Basis und von verschiedener Ausdehnung, die den Choledochus teilweise bedeckte. Dies wurde bei 39 Negern (23 männlichen und 16 weiblichen) und bei 46 Weissen (33 männlichen und 13 weiblichen), d.h. bei 42,5% des Gesamtmaterials beobachtet.

Gruppe 2: Fälle mit einer einzigen pankreatischen "Lingula" mit kaudaler Basis, die den ganzen pankreatischen Abschnitt des Choledochus bedeckte. Dies wurde bei 34 Schwarzen (21 männlichen und 13 weiblichen) und bei 26 Weissen (21 männlichen und 5 weiblichen), d.h. bei 30% des Gesamtmaterials beobachtet.

Gruppe 3: Fälle ohne pankreatische "Lingula." Die pankreatische "Linguala" des Choledochus lag nur in unmittelbarer Nähe der Hinterfläche des Pankreaskopfes, mit dem sie durch eine lymphatische, arterielle und venöse Elemente enthaltende verbindende Membran in Zusammenhang stand. Dies wurde bei 14 Negern (7 männlichen und 7 weiblichen) und bei 19 Weissen (15 männlichen und 4 weiblichen), d.h. bei 16,5% des Gesamtmaterials beobachtet.

Gruppe 4: Fälle mit doppelter "Lingula"; eine obere an der kranialen und eine untere an der kaudalen Basis, immer in unmittelbarer Nähe des freien Randes. Dies wurde an 10 Negern (6 männlichen und 4 weiblichen) und an 8 Weissen (5 männlichen und 3 weiblichen), d.h. an 9% des Gesamtmaterials beobachtet.

Gruppe 5: Fälle mit selteneren morphologischen Variationen. In dieser Gruppe befanden sich 3 Neger und ein Weisser, d.h. 2% des Gesamtmaterials.

Die Untersuchung seiner Beobachtungen führt den Verfasser zu folgenden Schlussfolgerungen:

1. Die kleine einzelne oder doppelte pankreatische "Lingula" an der Hinterfläche des Pankreaskopfes, die den pankreatischen Abschnitt des Choledochus teilweise oder völlig bedeckt, ist eine häufige Bildung, die an 83% der Fälle zur Beobachtung kam.

2. Das Fehlen der "Lingula" konnte an 16,5% der Fälle bestätigt werden.

3. Der präpankreatische Choledochus ist eine selten Anomalie, die nur in 0.5% der Fälle (bei einem unter 200) vorhanden war.

4. In allen Fällen von pankreatischer "Lingula" liess sich ein spaltförmiger Raum finden, der eine Freilegung der "Lingula" gestattete.

5. In etwa 60% der Fälle ist der retropankreatische Abschnitt des Choledochus leicht zugänglich, weil er entweder garnicht oder nur zu einem kleinen Teil von Pankreasgewebe überlagert ist, oder weil er von zwei "Lingulae" bedeckt ist, deren Lippen auf der Höhe der Hinterfläche des Gallengangs nahe beieinander liegen.

6. In 40% de [illegible] "Lin

dick und bedeckt den Gang entweder völlig (30%) oder nur zwei Drittel oder die Hälfte seines proximalen Abschnittes. In diesen Fällen ist die Freilegung des Choledochus sehr schwierig.

7. Die Unterschiede der Beobachtungen bezüglich der beiden ethnischen Gruppen und des Geschlechts ergeben wichtige statistische Daten.

## RÉSUMÉ

En utilisant le matériel d'autopsie, les auteurs ont disséqué les "lingulae" pancréatiques chez 100 blancs (75 hommes et 25 femmes) et chez 100 nois (59 hommes et 41 femmes).

Le matériel fut fixé dans une solution à 10% de formaline.

Les observations furent divisées en 5 groups.

Groupe 1: Cas d'une "lingula" pancréatique unique recouvrant partiellement le cholédoque. Il fut observé chez 39 noirs (23 hommes et 16 femmes) et chez 46 blancs (33 hommes et 13 femmes), soit 42.5% du total.

Groupe 2: Cas d'une "lingula" pancréatique recouvrant entièrement la portion pancréatique du cholédoque. On l'observa chez 34 noirs (21 hommes et 13 femmes) et chez 26 blancs (21 hommes et 5 femmes), soit 30% du total.

Groupe 3: Cas chez lesquels il n'y avait pas de "lingula" pancréatique. On a observé cette variété chez 14 noirs (7 hommes et 7 femmes) et chez 19 blancs (15 hommes et 4 femmes), soit 16.5% du total.

Groupe 4: Cas de double "lingula" pancréatique. On en a observé chez 10 noirs (6 hommes et 4 femmes) et chez 8 blancs (5 hommes et 3 femmes), soit 9% du total.

Groupe 5: Cas chez lesquels on remarqua des variations morphologiques moins fréquentes. Ils comprenaient 3 noirs et 1 blanc, soit 2% du total.

L'auteur tire des conclusions tres intéressantes.

(Pour leur donner toute leur valeur, il est préférable, afin d'éviter les malentendus, de lire le texte original.)

## RESUMEN

En autopsias se disecó la língula pancreática relacionada al colédoco en 100 especímenes blancos (75 hombres y 25 mujeres) y en 100 especímenes negros (59 hombres y 41 mujeres), con tipos raciales más ó menos definidos basándose en las características somáticas esenciales.

Los especímenes fueron fijados en una solución de formaldehido al 10 por ciento.

Las observaciones se presentan en cinco grupos en orden decreciente de frecuencia, las formas transicionales se subordinaron a subgrupos.

Grupo 1: Casos de "lingula" pancreática única de base caudal y extensión variable, cubriendo parcialmente al colédoco. Esto fué observado en 39 especímenes de negro (23 hombres y 16 mujeres) y 46 especímenes de blanco (33 hombres y 13 mujeres), en total fué 42.5 por ciento.

Grupo 2: Casos de "língula" pancreática única de base caudal cubriendo completamente la porción pancreática del colédoco. Esto fué observado en 34 especímenes de negro (21 hombres y 13 mujeres) y 26 especímenes de blanco (21 hombres y 5 mujeres), en total fué 30 por ciento.

Grupo 3: Casos en los cuales no había "língula" pancreática. La "língula" pancreática del colédoco estaba unicamente anexa a la cara posterior de la cabeza del páncreas ó adherida a ella por medio de una membrana coalescente conteniendo elementos linfáticos, aretriales y venosos. Esto fué observado en 14 especímenes de negro (7 hombres y 7 mujeres) y 19 especímenes de blanco (15 hombres y 4 mujeres), en total fué 16.5 por ciento.

Grupo 4: Casos de doble "língula," una superior de base craneal y otra inferior de base caudal, siempre anexas al borde libre. Esto fué observado en 10 especímenes de negro (6 hombres y 6 mujeres) y 8 especímenes de blanco (5 hombres y 3 mujeres) en total fué 9 por ciento.

Grupo 5: Casos en los cuales hubieron variaciones morfológicas menos frecuentes. Incluyen 3 especímenes de negro y 1 espécimen de blanco, 2 por ciento en total.

Del análisis de sus resultados el autor deriva las *siguientes conclusiones*:

1. La "língula" pancreática pequeña, solitaria ó doble, en la cara posterior de la cabeza del páncreas cubriendo parcial ó completamente la porción pancreática del colédoco es una estructura frecuente, habiéndose observado en el 83 por ciento de los casos.

2. Se comprobó ausencia de "língula" en el 16.5 por ciento de los casos.

3. El colédoco prepancreática es una anolmalía rara. Se presentó en el 0.5 por ciento de los casos (uno en 200).

4. En todos los casos de "língula" pancreática se encontró un plano de despegamiento que permitió spararla.

5. Virtualmente, *en el 60 por ciento de* los casos, el colédoco en su porción retropancreática es facilmente accesible, ya sea por que no se encuentra cubierto por tejido pancreático ó por que se encuentra cubierto unicamente en una pequeña parte de su longitud, ó por que se encuentra *cubierto por dos "língulas" cuyos labios* estan yuxtapuestos al nivel de la cara posterior del conducto.

6. En el 40 por ciento de los casos la "lingula" es gruesa. Cubre el conduccompletamente (30 por ciento) en sus dos tercios proximales ó en su mitad proximal. Bajo estas circunstancias el aislamiento del colédoco se hace difícil.

7. Las variaciones observadas con referencia a los dos grupos étnicos y a los dos sexos provee variaciones estadísticas significativas.

## RESUMO E CONCLUSOES

O autôr procedeu um cuidadoso e interessante estudo anatômico, tomando por base 100 brances e 100 negros, os quais *foram por si autopsiados.*

Dividio os especimens estudados em cinco grupos, e da analise detida sôbre suas observações, chegou as seguintes conclusões:

1. A pequena e isolada, ou dupla "lingula" pancreatica na face posterior da cabeça do pancreas, cobrindo pacrcial ou totalmente a porção pancreatica do coledoco, é uma formaçãi frequente, havendo *sido observada pelo autôr em 83% dos* casos.

2. A ausencia da "lingula" foi constatada em 16.5% das autopsias.

3. A localisação pre-pancreatica do coledoco é uma anomalia rara, tendo sido constatada em apenas 0,5% dos casos (1 em 200 observações).

4. Em todos os casos de "lingula" pancreatica existia um plâno de clivagem que permitia a sua libertação.

5. Em aproximadamente 60% dos casos o coledoco em sua localisação retropancreatica foi facilmente accessivel, tanto por não estar coberto pelo tecido pancreatico, como nos casos em que foi coberto em pequena extensão do seu trajeto, ou ainda por ter sido êle coberto pois duas "lingulas," os labios das quais estavam juxtapostos ao nivel da face posterior do canal.

6. Em 40% dos casos a "lingula" é delgada, cobrindo inteiramente o coledoco em 30% dos cadaveres, na sua metade ou nos seus dois terçes proximais. Em tais casos a liberatação do coledoco foi conseguida com grande dificuldade.

7. As cariações observadas com relação aos dois grupos raciais e aos dois sexos *dos cadaveres estudados, representam as* variações estatisticas de esabalho.

## RIASSUNTO

Con l'autopsia fu dissecata la língula pancreatica in rapporto col coledoco in 100 *bianchi (75 maschi e 25 femmine) e in* 100 negri (59 maschi e 41 femine), di razza più o meno pura così come è classificata dai caratteri somatoscopici essenziali. I camjioni vennero fissati in formaldeide al 10%.

Le osservazioni vengono presentate in *5 gruppi in ordine decrescente di frequenza*, qualcuno con sottogruppi, ai quali sono subordinate le forme di transizione.

Gruppo 1. Casi di lingula pancreatica unica e di variabile estensione, parzialmente ricoprente il coledoco. Ciò fu osservato in 39 soggetti negri (23 maschi e 16 *femmine) e in 46 soggetti bianchi (33* maschi e 13 femmine): 42,5% del totale.

Gruppo 2. Casi di lingula pancreatica unica ricoprente interamente la porzione pancreatica del coledoco. Ciò fu osservato in 34 soggetti negri (21 maschi e 13 femmine) e in 26 soggetti bianchi (21 maschi e 13 femmine) : 30% del totale.

Gruppo 3. Casi in cui non vi era la lingula pancreatica. La porzione pancreatica del coledoco era semplicemente giustapposta alla faccia posteriore della testa del pa, creas e aderiva per mezzo di una membrana contenente elementi linfatici, arteriosi o venosi. Ciò fu osservato in 14 soggetti negri (7 maschi e 7 femmine) e in 19 soggetti bianchi (15 maschi e 4 femmine) : 16,5% del totale.

Gruppo 4. Casi di lingula doppia. Ciò fu osservato in 10 soggetti negri (6 maschi e 4 femmine) e in 8 soggetti bianchi (5 maschi e 3 femmine) : 9% del totale.

Gruppo 5. Casi in cui vi erano variazioni morfologiche ancor più rare. I soggetti includono 3 negri e un bianco 2% del totale.

Dall'analisi dei risultati l'autore trae le seguenti conclusioni:

1. La lingula pancreatica unica o doppia sulla faccia posteriore della testa del pancreas, che ricopra parzialmente o totalmente la porzione pancreatica del coledoco, è una formazione frequente, essendosi potuta osservare nell'83% dei casi.

2. L'assenza della lingula si verificò nel 16,5% dei casi.

3. Il coledoco prepancreatico è una rara anomalia. Fu presente nel 0,5% dei casi (1 su 200).

4. In tutti i casi di lingula pancreatica era presente un piano di clivaggio che permetteva di liberarla.

5. Nel 60% dei casi il coledoco retropancreatico è facilmente accessibile, sia perchè non ricoperto da tessuto pancreatico o ne è ricoperto solo in piccola parte, sia perchè è ricoperto da due lingule le cui labbra sono giustapposte a livello della faccia posteriore del dotto.

6. Nel 40% dei casi la lingula è spessa. Essa ricopre interamente il dotto (30%). nei suoi due terzi prossimali o nella sua metà prossimale. In queste condizioni ferenti gruppi etnici e nei due diversi sessi costituiscono notevoli variazioni statistiche.

7. Le variazioni osservate nei due dif- l'isolamento del dotto presenta una certa difficoltà.

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**We thank the author for sending his thesis.

***The title in the German language corresponds to the data furnished by the author himself who kindly sent us the original work, published in Japanese, for the translation of which we are thankful to Mr. Fumio Chiba and collaborators

Aristotle, in spite of his reputation, is full of absurdities. He says that children should be conceived in the winter, when the wind is in the north, and that if people marry too young the children will be female. He tells us that the blood of females is blacker than that of males; that the pig is the only animal liable to measles; that an elephant suffering from insomnia should have its shoulders rubbed with salt, olive oil, and warm water; that women have fewer teeth than men, and so on. Nevertheless, he is considered by the great majority of philosophers a paragon of wisdom.

Superstitions about lucky and unlucky days are almost universal. In ancient times they governed the actions of generals. Among ourselves the prejudice against Friday and the number 13 is very active; sailors do not like to sail on a Friday, and many hotels have no 13th floor. The superstitions about Friday and 13 were once believed by those reputed wise; now such men regard them as harmless follies. But probably 2,000 years hence many beliefs of the wise of our day will have come to seem equally foolish. Man is a credulous animal, and must believe *something;* in the absence of good grounds for belief, he will be satisfied with bad ones.

—*Russell*

# Intestinal Suturing and Plication

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THE chosen methods of good surgeons tend to establish surgical technics. Deserved respect and admiration may blind students to basic principle and cause it to be forgotten. Yet, as better understanding comes with time, basic facts change.

Attention is turned so much toward method that "acceptable practice" acts to limit the improvement of method. This is not a new thing in our history.

Galen taught "This is what I do." Respect for that great teacher brought science in medicine to a pause of four hundred years. If Galen had been humble enough to debate "This is what I believe *now*," we might not have recorded his name, but we should owe him more.

The teaching of technics in some centers resembles indoctrination. I hear "Intestinal suturing is always by interrupted cotton or silk in the hands of the better men." This well-learned and obfuscating dogma of technic puts basic principle out of consideration. There is good reason to think back and then reassess the importance of basic aim in therapy.

Recent centuries have been studded with researches on the "prophylaxis of adhesions." Failure has been the honest report of all workers.

In 1850 it was agreed that lysis of adhesions increased the disorder and the disability.[1]

Control of adhesion re-formation after lysis has been an added and new concept since 1920. Plication has changed basic principle and so has added new method. First reported in 1937,[2] it has restored a normal intestinal physiologic status to the intestinal cripple from adhesions. Many have reported this result.[3] The picture of intestinal obstruction has been altered and brought under reasonable control.[4]

The work of Boys[1] properly placed a period to further research on the prophylaxis of adhesions.

A guide to new principles has been obtained from study of patients with advanced acute peritonitis and with extensive adhesions involving most of the small bowel in cases of multiple obstruction.[5] With both disorders, obstructions are multiple, and many may be complete when first seen. No tube can advance past the first of the complete obstructions. Therefore, time given to study of water balance, electrolyte replacement, etc., will be harmful if it extends past the need of preoperative preparation. There, of course, it is vitally important and life-saving.

Given, then, the need for plication and an understanding of its service, there is need for close inspection of certain basic principles of suturing if plication is to serve at its best.

1. The service supplied by the suture material is to hold loops of intestine in apposition through the time of their uniting.

2. The type of stitch controls the kind of apposition.

3. The late result, years later, can be controlled as needed by varied technics of plication.

The time of uniting varies with the presence or absence of peritonitis.

In the presence of peritonitis, I have seen loops of small bowel stick so tightly together in a space of ten minutes that a mild form of blunt dissection was required for their separation. First dissection preparatory to plication is therefore not done extensively, and the bowel is plicated as the dissection liberates intestinal fixations at abscess sites.

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In the absence of peritonitis existing at the beginning of the operation for adhesion obstruction, uniting of the plicated bowel will depend upon the inflammation *of healing, or a form of peritonitis. This* may be in response to trauma or suture peritonitis.[6] There must be some effective peritonitis for satisfactory union. The use of a theoretical nonirritating suture material is open to serious debate.

Since uniting is so prompt in the pres*ence of peritonitis, I use the suture mate*rial quickest to disappear. Plain No. 00 or chromic No. 00 catgut is preferred, because of the absorbable character of the materials and because finer catgut tears through the fragile substance of edematous intestinal wall. I see no equal value in any nonabsorbable material. All nonabsorbable material should be used in interrupted stitches, and these have many disadvantaages in cases of advanced acute peritonitis.

*The kind of apposition and union de*sired between loops of plicated intestine is not left to chance. A continuous line of union, as compared with a sort of spot welding, offers the choice to be made.

In the garment trade zippers have replaced buttons and buttonholes, because "gaposis" is a recognized pathologic entity. After plication of the bowel, there may be traumatic ileus or ileus due to existing peritonitis or any of several other causes. Local distention may tear spot welding points apart and defeat the whole operation. At best, I have seen spots so united by interrupted sutures separate, with long lines of rope adhesion connecting them, later. I argue constantly against interrupted suturing.

Thomeret[7] has decided that there is no need to begin the suture line at the base of the mesentery. He does not sew the mesentery.[8] Others begin the suture line *at the apex of the fold of plication, mak*ing the mesenteric approximation last. I am thoroughly in favor of differences of viewpoint, and so continue advocating the beginning of the suture at the base of the mesentery, using continuous sutures, and absorbable material.

There is a feature not to be overlooked: In the use of interrupted sutures, it takes consideraably longer to tie 100 knots than it does to insert 50 continuous sutures, or less.[9] *Time, in all cases of advanced* peritonitis, or of extensive obstructing adhesions, is a very limited commodity.

So, for better linear approximation of plicated bowel, for the avoidance of "gaposis" and for the sake of time under the stress of the patient's grave condition, I *recommend the use of continuous sutures* in all cases. This type of stitch gives the kind of apposition of intestinal surfaces that has proved most satisfactory, both at the time of operation and during the years *of freedom from disability resulting there*from.

The desired end result of plication of various segments or lengths of intestine calls for different purposes and aims. Varied technics of plication suturing may supply that result for the patient in the *years ahead. It may be that the form of* the intestine in plication should be maintained forever, as has been noted with regard to the use of plication to correct intussusception.[10] It may be that one de*sires the dynamic activity of peristalsis to* stretch the peritoneum and so returns the plicated intestine to normal shape and appearance, as with plicated sigmoid.

A review of case experiences may serve to exemplify enough of the purposes of plication and consequent need for varied suturing technics to clarify some of the thinking on these matters.

## REPORT OF CASES

provement. Intubation had to be repeated frequently. Plication was considered "ineffective because of some neurologic disturbance to the mechanism of peristalsis."

I first saw the patient after this final determination had been made. He showed all the evidences of partial intestinal obstruction; dilated loops of small bowel with detectable splash, obstinate inability of the intestinal tract to function. He was prepared, and his fifth surgical experience was undertaken.

As a matter of preference, I consider the ileocecal juncture the point of beginning of orderly dissection and plication, recognizing the fact that in some instances a great deal of work must be done before this region can be reached. Intestine fused tightly to the abdominal wall offered some delay in the approach to the cecum.[11]

The method of the previous plication was easy to see, being marked clearly in black silk knots. The loop of plication nearest the cecum, arbitrarily called the first wing because I choose to deal with it first, was not done as recommended. The apex of the V of the plicated loop should be pointed toward the patient's chin.[12] In this instance it was pointed downward and into the pelvis. The loop was about 10 inches (25 cm.) in length, involving some 20 inches (50 cm.) of ileum.

This first wing of plication was fused solidly to the peritoneal floor of the pelvis, with the sigmoid firmly fixed to its upper surface. Around it and under its mesentery, other loops of free small bowel had become adherent. This intestinal tangle was dissected without disturbing the form of the plication, which was studied carefully.

All black knots had been tied snugly and cut close. I inspected 100 knots for statistical calibration. More than 80 had no contact with at least one of the two original parts of intestine into which it had been sewn. Many had no contact with both walls of the plicated intestine. If the nonabsorbable suture will cut away from one loop of apposed intestine; what is the need of asking it to remain longer than it takes to cut through the intestinal peritoneum?

Spot union with spot welding is good only when the welded parts have rigidity of themselves, permitted gaposis between silk sutures. Some of these had made local fibrin union at the point of suture, and time had made this union stretch out into a band. Danger was offered to free loops of small bowel.

Why had there been fibrin union? Had it been due to suture peritonitis of the "nonirritating" silk, or was it due to the tissue necrosis from the tied knot? Had surgical trauma been a causative factor? As long as we can be uncertain, there is chance for growth in surgery.

The case for interrupted sutures and nonabsorbable material lost ground as I inspected this end result of former plication.

I severed all adhesions, including those made by the plication that had been done. I plicated the entire small bowel, beginning at the cecum and ascending to the ligament of Treitz. I used continuous No. 00 chromic catgut. Following the recommendation of Thomeret,[13] since this patient had already undergone too many operations, I left no loop of normal intestine unplicated.[14] There was much of the small bowel that showed no adhesions, but the preventive plication of all bowel insures that there will be no adhesion obstruction and no interference with normal physiologic function.

This patient made an uneventful recovery to a normal intestinal physiologic status. He has remained symptom-free for the first time since the adhesions began. At the time of writing, more than two years have passed.

CASE 2.—C. G., a woman, was seen at the age of 19 and again at the age of 23. In her case an aim in plicating was successfully accomplished.

The peritoneal sac of a hernia suggests the future of a loop of plicated small or large bowel. The ability of the peritoneum to expand to a great extent over an enlarging hernia is taken for granted, having been observed so frequently.

The dynamics of intestinal activity after plication put considerable pressure on the united lines of sutured peritoneum.[14] Peritoneum regenerates along fibrin bundles,[15] so that point union should be expected to give rise to bands of stretched adhesions. Linear union of plicated loops of bowel may be followed by stretching of peritoneal sheets, similar to the formation of the herniae sac. These are observed facts. We use the lessons learned.

In C. G., peritonitis developed from a ruptured appendix. She spent three months in the hospital, never free of distension or the need of tubation. The loss in weight was continuous. The course of convalescence was disturbing, in that improvement was transitory but frequently promising. The need of plication was recognized and it was therefore done.[16]

There were small abscesses at the mesenteric base all along the small bowel. There was little destruction of peritoneum along the intestine itself. Partial obstructions were multiple and due to fixations over abscess sites. After liberation of all abnormalities the entire small bowel was plicated, No. 00 chromic and continuous sutures being used.

Return to health and symptom-free well-being was uneventful. A year after marriage the patient came to operation for simple ovarian cyst, and inspection of the former field of peritonitis was possible.

In plicating, only the peritoneum was included in the stitches. Linear approximation of peritoneal surfaces was accomplished by continuous suture and by wrinkling the bowel along the taut suture. (This is the opposite procedure from the occasionally seen support of loops by instrument, so that after suturing there are open spots between surfaces that should be solidly apposed.) The physicians who had treated the original peritonitis and plication were again assembled when the operation for the cyst was performed. Photographs had been taken of the first operation and plication.

When the abdomen was opened there was no evidence of the former plication. In four years peristalsis had stretched the peritoneum so that all small bowel was free on its mesentery as if nothing had been done. On close inspection with parallel ray light, stress lines could be seen, clearly indicating the stretching of the peritoneum. There was no spot union, and consequently no bands of adhesions were scattered along the bowel. Like the peritoneum of a herniae sac not exposed to truss pressure, the small bowel peritoneum seemed close to normal.

(This case warrants a contrasting note. Plication at the site of reduced intussusception offers insurance of no return. Bearing in mind the ability of the peritoneum to stretch, I do not use simple peritoneal suturing with intussusception. The peritoneum is incised and subperitoneal tissue is sewed together for certain permanence. This variation of plication suture is reasonable and is performed for a definite purpose.

In a current volume on surgery, the treatment of recurrent intussusception is dismissed with "Recurrence is rare." The Mayos reported the case of an infant with three intussusceptions of the same segment of bowel in one year.[16] One case is enough to warrant adding one minute to the time of operation to effect plication in permanent form at the site of intussusception. The union of subperitoneal layers is the obvious means of securing permanent prevention of intrussusception.)

In the case of C. G., since plication with complete linear apposition of peritoneal surfaces was all that was needed, it did not matter whether the plication remained forever or whether the peritoneum stretched on planes to reform again the apparent condition of normality.

The suturing of the plication in the case of C. G. was done with No. 00 chromic catgut and continuous stitch for each loop. This lasted throughout the time needed for uniting. Apposition in a continuous plane or surface was desired because of need for eliminating bands from local point stretching of united peritoneum in the years to follow. The late and final result was a return to apparent normality, due to the kind of suture material used and the stitch with which it was applied.

CASE 3.—The case of this patient, a woman, belonged to another physician and demonstrates a complication that might accidentally affect statistics.

The patient had undergone operation for pelvic disease, with need for recurrent release of obstructive symptoms. Finally she came to Dr. L. C., who untangled the entire small bowel from adhesion fixation obstructions. After three months of complete relief from symptoms, sudden partial obstruction occurred. Quick relief followed intubation. Roentgenograms demonstrated no lag, no pocketing and no evidence of abormality.

Repeated similar bouts brought the patient to reoperation for "adhesions." The plicating surgeon, L. C., was doubtful as to his application of the technic. There had been so much peritoneum destroyed before his plication that his doubt was based on the possibility of cicatricial contracture of some loop, without roentgen evidence.

When the abdomen was opened, since I begin at the cecum for all inspection, I saw the spontaneous unfolding of an intussusception of the terminal portion of the ileum into the cecum through a rather large ileocecal ring. There was no peritoneal fibrin deposit to indicate previous inflammation, and this was taken to explain the mildness of the symptoms and the ease of recovery from eac

Plication of the terminal portic
ileum was done, that
bowel being brought

white bands of the ascending portion of the colon. Subperitoneal tissues were exposed and sewed together with No. 00 continuous chromic catgut, as with all intussusceptions.

The plication of the small bowel as it had been done was in permanent position because of the immense damage to the peritoneum. There was no evidence of any malfunctioning part of the small bowel, this corroborated the roentgen observations.

The patient made a quick recovery and has remained symptom-free more than five years.

CASE 4.—The patient was Mrs. C., 30. The eight months preceding her admission had seen the continued use of Levine or Miller-Abbott tubes. Her weight had gone from 120 to 59 pounds (54.4 to 26.8 Kg.). The abdomen was greatly distended and silent.

There had been 4 previous operations. In the effort to prevent adhesions, hyaluronidase had been used in the peritoneal cavity.

The entire anterior abdominal wall was fused to loops of small bowel, the omentum being scant and in the upper part of the abdomen. Most difficult sharp dissection was necessary throughout the length of the small bowel and its mesentery. Not as much as one square inch of glistening peritoneum was identified along the small bowel or its mesentery.

The silent abdomen suggested paralytic ileus due to obstruction and disuse. The trauma of resolving the pathologic condition would add to this. I began pituitrin on admission in anticipation of difficulties arising from an adynamic ileus.[17] An ampule of the stronger concentration was given hourly.

Little is known that would provide a reasonable measure through which one might anticipate return to normal peristaltic activity. The normal functions of secretion and absorption of the small bowel may be restored, too, after release from obstruction, but again, when?

Pituitrin was continued until several days after there had been apparent return of a normal intestinal physiologic picture.

In plicating the entire small bowel, I saw that sutures need serve for only a few minutes. Separated loops stuck fast as soon as they were dropped after liberation. An interesting observation came from the beginning of peristalsis under the influence of heavy doses of pituitrin. As loops were freed from their obstructing adhesions, peristalsis became active. The new sticking together by the accident of position after dissection and in view on the abdomen was not disturbed by the most active peristalsis. *I have noticed this* many times. I have, accordingly, little faith in the idea that anything can dissolve or break up or prevent adhesions, where it is the natural response to insult or effort to heal the peritoneum.

Careful linear approximation of intestinal *loops in plication, and as careful folding* and suturing of the mesentery, were done from cecum to the ligament of Treitz.

Since there was no visible or identifiable peritoneum and since the adhesion of the antimesenteric surfaces to the anterior abdominal wall was expected, there was little doubt that this plication of this bowel would be permanent. I have noted in many patients that fusion to the abdominal wall is of no consequence and is not productive of symptoms when continuous plication has been done.[18]

*This patient has recovered normal weight,* normal physical activity, normal appetite and normal freedom from the apprehension of return of obstructive symptoms. More than a year has passed since this recovery.

In conclusion, no discussion of suturing is complete without mention of the work of several men.

Robert Smith[19] has proved beyond argument what may result from the use of certain suture material in plication. Cotton may set in motion a slow softening of the intestinal wall. This he showed in photomicrographs.

Thomeret noted the tendency of some patients to respond generally to local suturing of intestine, and so advocated complete plication of all small bowel in every case, to eliminate wandering fibrin bands that may obstruct loops of undamaged and unplicated bowel. I have had 2 cases in which this would have been warranted; 2 cases in thirty-four years and some 1,300 cases. Statistically, the percentage is against total plication in all cases, but every case is 100 per cent, whatever direction it may take.

Donaldson and Cameron[20] considered silk to be less productive of adhesion formation. Their work was done with laboratory animals. The question may well be, does one not want quick adhesion formation during the first hours of union after plication?

*In considering the works of Ripstein,*[21] Lord, Howes and Jolliffe, and others, one may come to the understanding that suturing *in every case need not be the* same; and that plication effected by any means is adequate to handle the conditions of obstruction from adhesions or from peritonitis.

### SUMMARY

The author discusses suturing in plication, *which in his opinion, should accomplish* three things:

1. It should hold the mesentery and intestine as sewn only through the minutes required for primary union.
2. It should provide linear apposition of surfaces as contrasted to spot union.
3. It should be controlled by the need for permanent union or for temporary fixation *with expected stretching of surfaces*.

The author therefore uses absorbable material, continuous stitches, and peritoneal or subperitoneal union as required continuing now as he began the first plication in 1920.

### ZUSAMMENFASSUNG

Der Verfasser erörtert das Nähen in Falten, das sich nach seiner Ansicht für die folgenden drei Zwecke eignet:

1. Die Faltennaht sollte Mesenterium und Därme nur für die Minuten, die zur primären Vereinigung erforderlich sind, in Position halten.
2. Die Faltennaht gestattet im Gegensatz *zur Punktnaht eine lineare Angleichung* von Oberflächen.
3. Die Anwendung der Faltennaht sollte davon abhängen, ob ein Bedürfnis nach endgültiger Vereinigung oder vorübergehender Fixierung in Fällen, wo eine Dehnung der Oberflächen zu erwarten ist, besteht.

Der Verfasser benützt weiterhin, so wie er es *seit seiner ersten Fältelung im Jahre* 1920 getan hat, absorbierbares Material, fortlaufende Nähte und-je nach Bedarfperitoneale oder subperitoneale Vereinigung.

### RÉSUMÉ

L'auteur discute la duplicature intestinale, laquelle, d'après lui, devrait respecter trois faits :

1. Cette duplicature devrait réunir les surfaces du mésentère et celles de l'intestin.
2. Cette façon de procéder devrait empêcher la formation d'adhérences.
3. Cette duplicature devrait être faite, selon les cas, temporairement ou d'une façon définitive.

Dans ce but, l'auteur utilise du matériel résorbable, une suture continue, poursuivant la méthode qu'il avait utilisée pour la première fois en 1920.

### RESUMEN

El autor discute sutura en el plegamiento intestinal (plication), que en su opinión debe de lograr tres cosas:

1. Debe sostener el mesenterio e intestino, cosiendo con la minuciosidad re*querida para la unión primaria.*
2. Debe de proporcionar una adaptación lineal de las superficies.
3. Debe ser controlada por las necesidades de una unión permanente ó por una fijación temporal en la que se espera estiramiento de las superficies.

Por consiguiente, el autor usa material inabsorbible, suturas continuas y unión peritoneal ó subperitoneal segun se requiera, continuando actualmente en la misma forma en que hizo su primer plegamiento peritoneal en 1920.

### RIASSUNTO

L'autore sotiene un metodo di sutura che, nella sua opinione, risponde a tre requisiti:

1. Mantiene uniti il, mesentere e l'intestino solo per il tempo necessario all'unione primaria.
2. Consente un affrontamento lineare *delle superfici.*
3. Può servire tanto per fissazioni permanenti come temporanee.

L'autore materiale riassorbibile e suture continue.

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* * *

An obstinate man does not hold opinions, but they hold him.

—*Butler*

A narrow mind begets obstinacy; we do not easily believe what we cannot see.

—*Dryden*

None so blind as those that will not see.

—*Henry*

The mind of the bigot is like the pupil of the eye; the more light you pour upon it, the more it will contract.

—*Holmes*

# The Plastic Flap in Closure of the Pilonidal Cyst Excision Defect

## Experience with Twenty-Five Cases

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THIS paper is the result of an effort to find an easier and simpler solution to the problem of the pilonidal cyst and sinus excision defect — a solution that might take a little longer at the operating table but would require less preoperative and postoperative care, and would permit early ambulation, fewer dressings and earlier return to work with a closed, well healed operative site.

The wealth of material published with regard to the treatment of the pilonidal cyst and sinus is ample evidence that as yet no definite technics either closed or open, has been entirely satisfactory.

The problem is not complete excision of the tract, as this is essential to any successful procedure. It resolves itself into either healing of the excisional area by granulation or by primary closure.

1. *Simple Excision and Granulation.*—This is the basic procedure, which has been evaluated from the standpoint of hospital stay and especially of low percentage of recurrences in a comprehensive survey by Rogers of the Massachusetts General Hospital and others.

The objection of both surgeon and patient is the length of time required for the granulation process to fill in the defect and epithelize. While an average of fourteen and four-tenths weeks is reported, there are many cases in which months and even a year may ensue before complete healing takes place.

Even then, the epithelial covering is so thin that it is easily traumatized and reopened for an additional period of dressings. This is in spite of excellent cooperation by the patient and the use of all the suggested methods of promoting wound healing.

Granulation is really expensive to the patient, and the prolonged dressings are a nuisance to both him and the surgeon. The good things about it are that the resultant scar is not particularly disfiguring and the percentage of recurrence relatively low.

2. *Excision and Partial Primary Closure.*—This method consists of undercutting the edge of the skin after excision of the cyst and suturing this edge to the presacral fascia, leaving a granulating area over the sacrum to epithelize later or be treated with a skin graft. This is a compromise between the open and closed methods and an effort to salvage as much as possible of the advantages of both. It is still granulation, however, and requires considerable care to avoid the entire area opening when the cutaneous sutures slough out or are removed.

3. *Excision and Primary Closure of the Defect.*—This method covers a variety of technics. Many of these were devised in Army and Navy Hospitals during World War II, in an effort to speed up convalescence and early return to duty.

Essentially it consists of using bi-elliptic incisions for removal of the cyst and sinus tracts and closure in several layers with suture material varying from catgut to stainless steel wire. With these m[illegible] should take as [illegible] undercut the [illegible]

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*Senior Visiting Surgeon, Woonsocket Hospital. Submitted for publication Dec. 9, 1953.

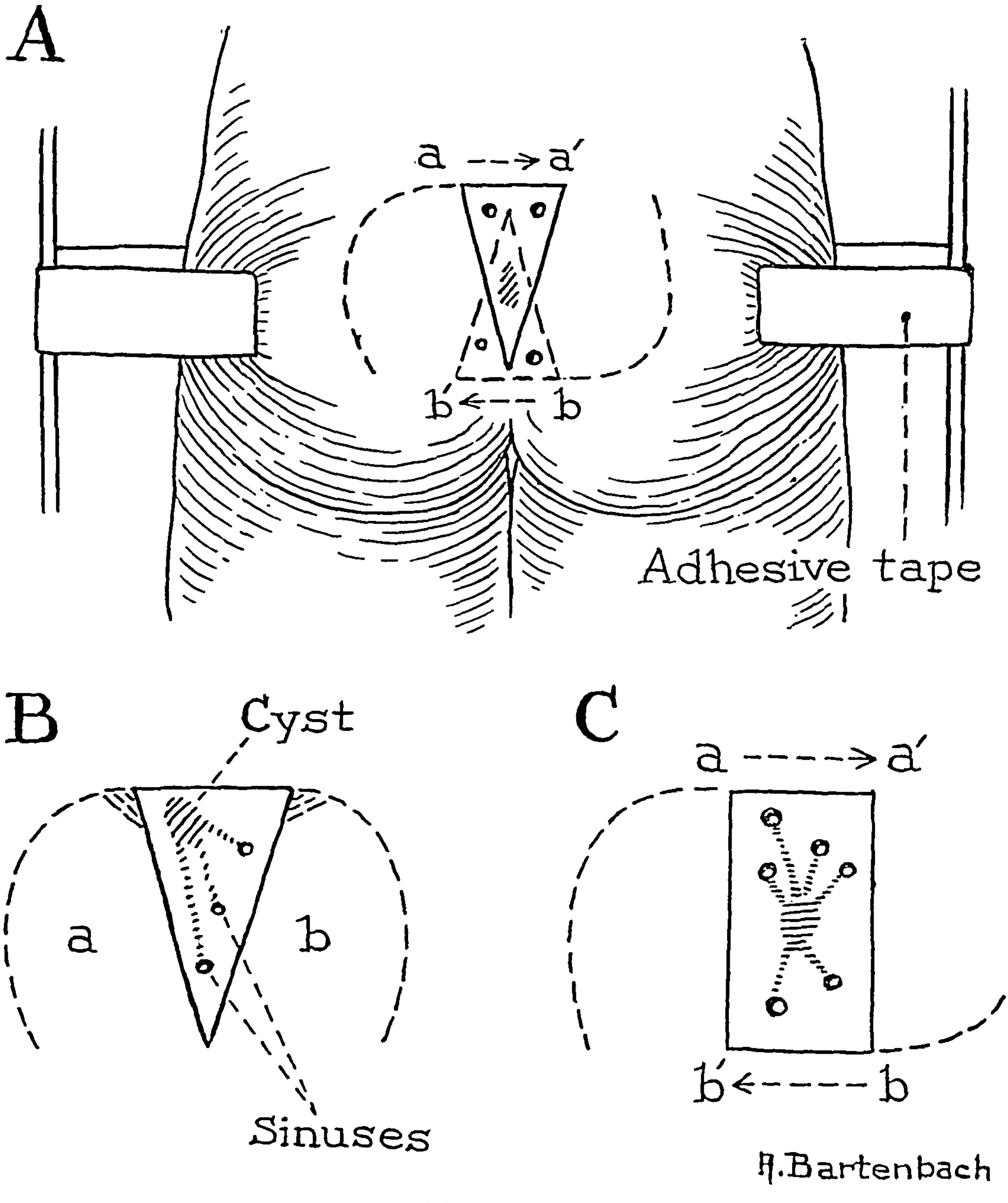


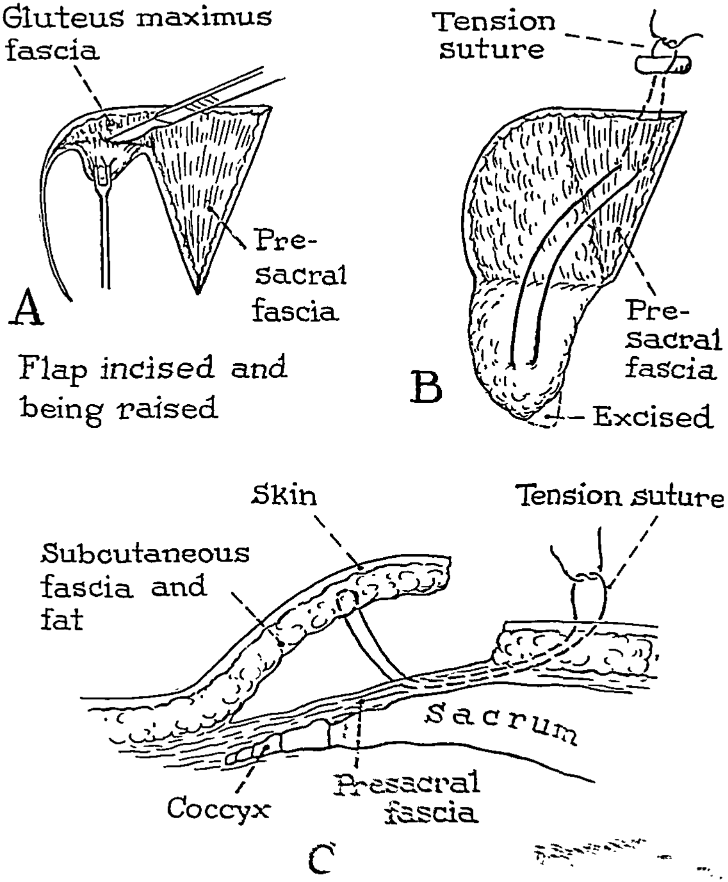
Fig. 1 (see text).

walls wedge-shaped or by deliberately incising the subcutaneous tissue. Pope has suggested mobilization of the gluteus maximus muscle to assist in this closure. He has reported a high percentage of successful results.

Although primary closure by any of these methods is excellent when it is successful, it necessitates extremely careful technics, prolonged hospitalization both preoperatively and postoperatively, and exceptional postoperative care to prevent the entire wound from breaking open and reverting to healing by granulation.

It is hardly possible to close this defect without tension on the sutures, a primary requisite to good healing, as well as eliminate the dead space beneath. This fact is *well evidenced by the type of sutures used* —either heavy, nonabsorbable material or vitallium wire. Then too, failure, no matter how infrequent, results in complete opening of the wound with the aforementioned *prolonged healing by granulation.*

4. *Closure by Full Thickness Double-Ended Skin Flap* (Lahey Technic).—This is a highly successful method but which leaves the problem of the defect in the



Flap incised and being raised

buttock—this either must be skin grafted or allowed to granulate with a resultant wide buttock scar.

5. *Closure by the Broad-Based Pedicle Flap.*—This method uses the full thickness of skin and superficial tissue. The graft is not new in this area, having been used with remarkable success in the closure of decubitus ulcers in paraplegic patients; there can be no greater test of its stability. A good firm closure in such a patient must insure an even better closure in a patient not suffering the trophic disorders of damage to the spinal cord.

It is a versatile method, in that the flap can be swung from a caudad or cephalad base or, in rectangular defects, from both. In long thin triangular defects its curve may start at any point on either leg that appears to fit the circumstances of the case, with good expectation of success.

It is relatively safe—with the observation of a few cardinal points the danger of slough or complications should be minimal.

This method has been used in 25 cases over a period of seven years and has been so successful therein that, although the series is small, this report seemed indicated. There has been but 1 semifailure, and only 2 minor recurrences have been encountered, which were treated by a similar technique.

*Preparation of the Patient.*—*Acute Conditions:* When a fulminating infection is present the treatment of choice is sitz baths, penicillin administered parenterally and incision and drainage when indicated until the acute process subsides. With this therapy, upward of one week may be all that is necessary.

*Subacute or Chronic Conditions:* The patient is admitted to the hospital on the day prior to operation, and sitz baths with tincture of green soap solutions are ordered for the night before and the morning of operation.

Adequate preparation of the skin is also ordered, a wide area of both buttocks and perineum being shaved. Pencillin, 400,000 units, is given intramuscularly. The question of adequate serum protein levels, vitamins and hydration should be no problem, as the majority of the patients are young and healthy. Blood or fluids at the time of operation may be necessary and should be prepared.

*Operative Procedure.*—*Step 1:* The patient is placed in the prone position with the buttocks elevated and controlled either by adhesive tape or by weighted wire hooks.

The operative area is scrubbed with soap and water, after which ether and a skin antiseptic, such as tincture of merthiolate, are applied.

Excision is made in a triangular fashion (instead of the usual semi-elliptical technic) down to the presacral fascia. This is done because the sinus tract usually extends to one side or the other into the buttock and either anteriorly or posteriorly.

The base of the triangle may be either caudad or cephalad, depending on the site of the tract. The excised area is then examined to be sure the total pathologic portion has been removed, and all bleeding points carefully controlled.

*Step 2:* From the base of the excised triangle a curved incision is made; this line is continued around so that a broad-based flap is formed and freed upward from the gluteus maximus fascia. All bleeding points are again controlled, and the flap is brought over the denuded area.

It is essential that an *adequate* base be allowed in order to nourish this flap. It should be marked out in advance of actual incision by scratching or with a skin pencil. It should be roughly equal to the width of the original triangle excision base. This is to insure that no sloughing will occur at the apex of the flap since this would delay healing.

A small triangular area is next removed from the apex of the new flap, because it has been observed that the circulation of this area is usually questionable and may cause a minor slough if the tissue is not excised.

*Step 3:* The previously applied adhesive or wire traction is now removed and the flap anchored to the presacral fascia by a single through suture tied over a gauze

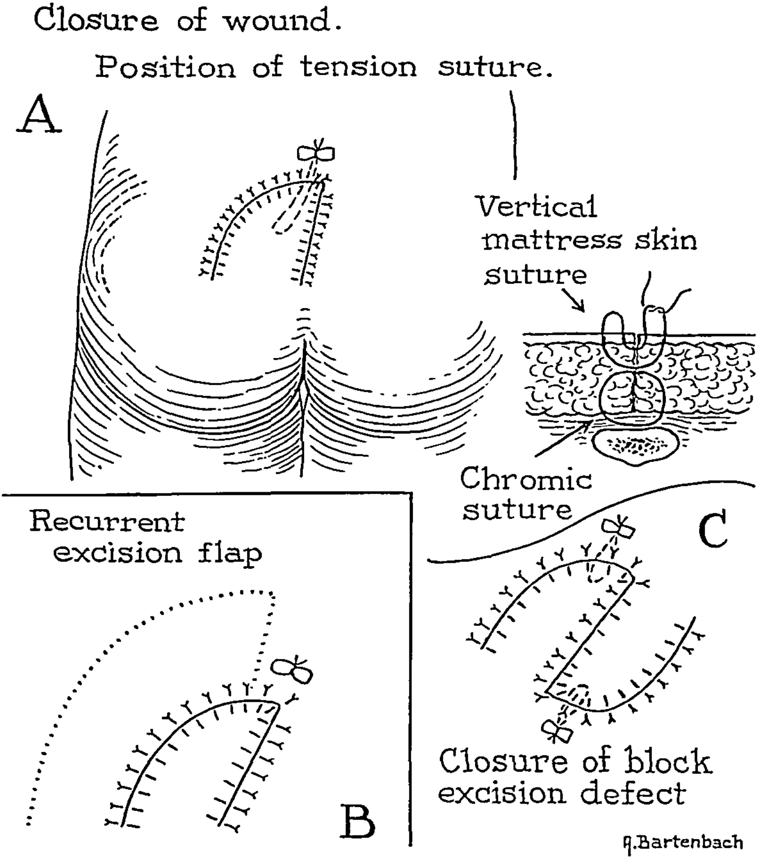

Closure of wound.
Position of tension suture.
A
Vertical mattress skin suture
Chromic suture
Recurrent excision flap
B
C
Closure of block excision defect
G.Bartenbach

Fig. 3 (see text).

buffer. This suture is started outside the wound area, above the original triangular base. It is carried down through the presacral fascia, brought up through the undersurface of the flap sufficiently to provide a good purchase, then carried back through the sacral fascia and u close to the starting point.

The gauze buffer is ti to eliminate the dead s fering with the nutriti apex of the flap.

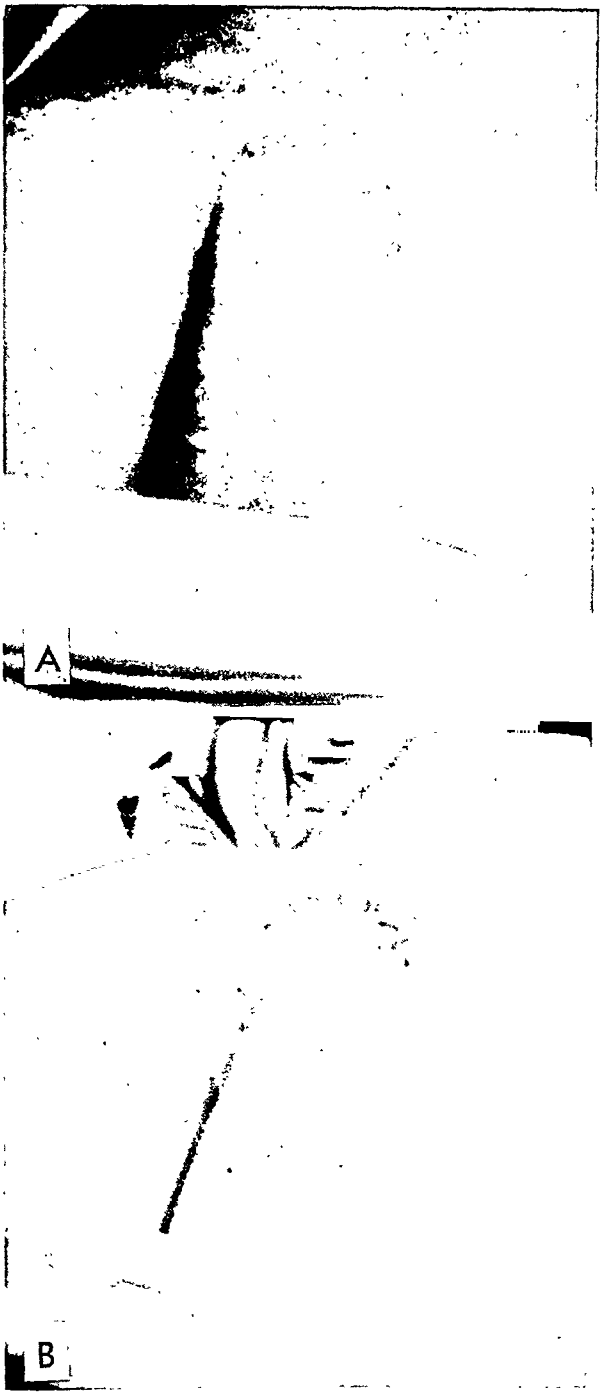


Fig. 4 (see text).

*Step 4*: The wound edges are sutured by a two-layer technic with interrupted No. 0 chromic catgut in the fat and subcutaneous tissue and interrupted cotton or silk in the skin. These skin sutures should be of the vertical mattress type and placed meticulously, so that good approximation and primary healing will take place with little or no tension on any one suture. This also prevents tiny epithelial invaginations with ingrown hair, whch may cause recurrences.

A voluminous dressing is applied, with adhesive strapping of the buttocks in the usual manner.

*After-Care.*—The flap is observed on the following day and the dressing changed daily to be sure that adequate circulation is present. If there is any question, the gauze pad is cut from the tension suture.

Procaine pencillin, 400,000 units, is given daily. The bowels may be controlled by low residue diet until the second day.

On the third day the tension suture is removed; an enema may be given; the patient is given a "house diet" and is allowed to go to the bathroom. On the fifth day he is discharged home, the remaining sutures to be removed on the seventh to the tenth day at the office. Usually at this time the flap is well healed, and he can return to his usual occupation in four to five weeks.

*Possible Complications.*—1. *Serous Accumulation Beneath the Flap:* This can be removed by the insertion of a large caliber (size 16) needle and syringe without disturbing the wound sutures and without danger to the flap itself.

2. *Slough:* This danger should be minimal provided a few cardinal points are kept in mind:

a. The base of the flap should be estimated and its extent marked. It should be as wide as the base of the defect.

b. The incision should be full thickness and down *to* but not *through* the gluteus maximus fascia.

c. All incisions should be made straight, without undercutting of the edges, if possible.

d. Buttons or other sources of pressure on the flap should not be used to eliminate dead space or for any other reason, as the circulation distal to this pressure will be interfered with and will slough.

3. *Infection.*—This is not a serious prob-

lem as a rule if adequate preoperative preparation is done and hemostasis during the operation is observed. If infection occurs, it is controlled by hot compresses and the antibiotics. It should not seriously affect the healing time.

4. *Spitting out of Deep Nonabsorbable Sutures.*—This was rather a nuisance in the first few cases, until it was found that chromic catgut in the subcutaneous fascia was just as suitable and obviated the formation of foreign body blebs and extrusion of the cotton or silk for months after the wound was apparently well healed.

*Recurrence.*—There were 2 so-called recurrences in this series, extending over a period of seven years. Both were treated as was the original cyst except that the area was much smaller. Both patients were hirsute, obese long-distance truck drivers. It was the impression that the constant irritation caused by the leather seat, perspiration and poor hygiene were instrumental in these recurrences. These were about the size of the terminal phalanx of one's little finger, had a chronic granulomatous appearance. They were easily excised and reflapped with, in 1 case, only three weeks' work loss. The treatment is shown in Figure 3*B*. In 22 cases full healing took less than six weeks, and in 18 healing occurred in four weeks. In 1 early case a slough of about one-third of the flap was caused by the use of a button; this necessitated a healing time of fourteen weeks, with small pinch grafts applied in the office for final closure of the area. The two recurrences were treated by swinging a small flap, with equal success.

From this series, it is my conviction that the use of a broad-based flap is a highly successful method of closure and offers minimal possibility of prolonged complications, as compared with any of the previous forms of treatment.

### SUMMARY

A plastic flap technic for closure of the defect resulting from excision of the pilonidal cyst and sinus is described, with a seven-year follow-up. The method presents the following advantages:

1. A healing time of four to six weeks can be expected.
2. Only a short period of hospitalization is required.
3. It relieves the surgeon of multiple dressings and prolonged after-care, and the patient of prolonged absence from work.
4. The flap graft covers the sacrum with a good cushion that is unlikely to cause subsequent tenderness or reopening of the wound.
5. Even if there is some sloughing of the apex through unfortunate circumstances, the healing time is not seriously prolonged, as cutaneous tension is relieved by the remainder of the flap.

### RÉSUMÉ

Une technique de greffe plastique pour combler le défect résultant de l'opération d'un kyste dermoïde et d'une fistule au neveu du rectum est décrite, avec un recul de sept ans. La méthode présente les avantages suivants:

1. Guérison obtenue dans un délai de 4 à 6 semaines.
2. Temps d'hospitalisation court.
3. Elle évite de multiples pansements et des soins post-opératoires prolongés; elle permet au malade de reprendre son travail rapidement.
4. Le sacrum est recouvert d'une greffe

Fig. 5 (see

bien étoffée, de telle façon que ce dernier reste insensible et ne fistulise pas.

5. Même s'il se forme une escarre, le temps de guérison n'est pas sérieusement prolongé, puisqu'il n'y a pas de tension cutanée.

### ZUSAMMENFASSUNG

Zur Schliessung des nach Exzision einer pilonidalen Zyste oder Fistel entstehenden Defekts wird die Technik einer Lappenplastik und ihre Resultate nach sieben Jahren beschrieben. Das Verfahren bietet die folgenden Vorteile:

1. Heilung kann innerhalb von vier bis sechs Wochen erwartet werden.

2. Der erforderliche Krankenhausaufenthalt ist kurz.

3. Das Verfahren erspart dem Chirur- häufigen Verbandwechsel und langwierige Nachbehandlung und ermöglicht em Kranken eine rasche Wiederherstellung der Arbeitsfähigkeit.

4. Die Lappenplastik deckt das Kreuzbein mit einer guten Polsterung, die eine spätere Empfindlichkeit oder ein Aufbrechen der Wunde unwahrscheinlich macht.

5. Selbst wenn es durch ungünstige Verhältnisse zur Abstossung der Spitze des Lappens kommt, verlängert sich die Heilungszeit nicht wesentch, da die Hautspannung durch den Rest des Lappens gemildert wird.

### RESUMEN

Se describe una técnica de colgajo para el cierre de un defecto resultante de la extirpación de un quiste pilonidal, con una observación de siete años. El método tiene las siguientes ventajas:

1. Un tiempo de cicatrización de cuatro a seis semanas.

2. Se requiere unicamente un período corto de hospitalización.

3. No requiere apósitos múltiples ni cuidados prolongados del cirujano y el paciente no se aparta largo tiempo de su trabajo.

4. El colgajo cutáneo cubre el sacro con buen acojinamiento que es díficil produzca dolor ó reapertura de la herida.

5. Aun cuando en circunstancias desafortunadas haya alguna necrosis en la punta del colgajo, el tiempo de cicatrización no se retarda grandemente, ya que la tensión cutánea es disminuída por el resto del colgajo.

### RIASSUNTO

Viene descritto un metodo di plastica a lembo per la cura delle perdite disostanza consecutive ad asportazione di cisti e fistole sacro-coccigee, controllato fino a 7 anni di distanza. I vantaggi sono i seguenti:

1. Consente la guarigione in un periodo di 4-6 settimane.

2. Richiede una ospedalizzazione di breve durata.

3. Risparmia molte medicazioni e cure post-operatorie e consente una precoce ripresa del lavoro.

4. Il trapianto copre il sacro con un discreto spessore di tessuti che prevengono i dolori e la riapertura della ferita.

5. Anche se vi è una piccola necrosi per circostanze sfavorevoli, il periodo richiesto per la guarigione non è lungo, dacchè il lembo restante impedisce la tensione della cute.

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To suspect a friend is worse than to be deceived by him.

—*La Rochefoucauld*

Every man should keep a fair-sized cemetery in which to bury the faults of his friends.

—*Beecher*

Friendship consists in forgetting what one gives, and remembering what one receives.

—*Dumas the Younger*

When friendships are real, they are not glass threads or frost work, but the solidest things we can know.

—*Emerson*

So long as we love we serve; so long as we are loved by others I *would almost say that we are indispensable; and no man is useless while* he has a friend.

—*Stevenson*

That friendship will not continue to the end which is begun for an end.

—*Quarles*

Friendship is a creature formed for a companionship, not for a herd.

—*Montaigne*

Friendship is the only cement that will ever hold the world together.

—*Wilson*

# Status of Extrapleural Pneumothorax

## Clinical Analysis of 150 Cases of Pulmonary Tuberculosis

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ISTANBUL, TURKEY

THIS report is based on the great interest in extrapleural pneumothorax at the Tuberculosis Hospital in Istanbul and the high level of efficiency achieved in its performance. I shall present the details and results of 150 such operations performed in this clinic in a serial investigation begun three years prior to the time of writing. The procedure is still avored here because of its reversibility and its selectivity.

In spite of the limited classic indications, I have been accustomed to operate on almost all patients not suitable for thoracoplasty and on those in whose cases pneumothorax had failed. In a great many cases sufficient improvement was obtained, thus fortifying my personal opinion that this operation is an excellent temporary collapse measure.

It is important to mention here that in the period between 1933 and 1935, in Prof. Nissen's clinic at the University of Instanbul, pneumolysis was also made the subject of systematic analysis, but experience was then still limited, and no large series were available to justify any conclusions as to the value of the procedure.

In analyzing the cases of 150 patients on whom I have operated, I must point out that the end results have not yet been obtained and that the time lapse is not sufficient to enable me to arrive at any definite conclusion or to formulate any sweeping statement. On the basis of the number of operations performed, however, I have a clear idea of the efficiency and selectivity of the technic and of its overall value. All the good results I have obtained are due to efficient cooperation between the surgical staff and the internists.

My first case was reported on May 19, 1949, and was, to the best of my knowledge, the first such case to be reported in Turkey. The patient, a woman, left the hospital improved but was not followed up. The second patient, fortunately, is still under observation. She was given every advantage of this classic treatment and is considered clinically cured.

After the apparently successful result in this second case, physicians were impressed by the method and the principles underlying it. The prolonged postoperative care, however, as well as the complications observed, frightened them and so limited its use. This fear was of great help to me, since it obliged me to improve my technic. With more intelligent selection of the patients, the results showed an improvement so consistently increasing that the negative attitude vanished.

In evaluating the results one must consider the various indications. In this series the pulmonary lesions varied from unilateral and isolated to bilateral and extensive. Of course, the results were not the same. This difference compelled a more careful selection of the patients.

The success of the method depends on certain principles and the achievement of certain goals. It is not merely a matter of careful operating; to be adjudged successful, the operation must be followed by well-planned postoperative supervision. Here the treatment is divided into two stages. Each stage has its importance as well as its complications. I accept the result as successful only if the postopera-

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Submitted for publication March 2, 1953.

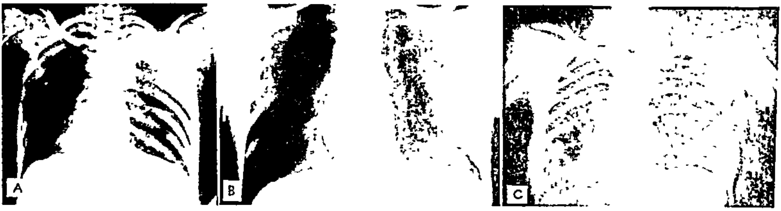

Fig. 1 (Case 1).—Miss L. G., aged 25. *A*, unilateral cavitary lesion, about one year old, located at upper part of right side. *B*, tomographic film in same case. *C*, film taken after operation on May 16, 1940. Cavity appears closed. Sputum normal. Patient considered cured. (Roentgenograms reversed; read left for right and vice versa.)

tive period, after a selective and sufficient collapse, is tolerated without complications. Postoperative care here depends on the social position and income of the patient; in my opinion, if this interferes so as to prevent the patient from remaining under prolonged supervision it may be wiser to avoid the whole treatment. Also, the physician in charge must have some knowledge of the operation and a practice of some duration in a surgical clinic. As a matter of fact, to make sure of adequate postoperative supervision, I prefer to operate on urban patients, since patients who come from the middle country seldom do well. They always leave the medical center early, and, away from adequate care, they often become subject to severe complications and return in worse condition than before. Many of these I have been unable to follow up.

Next to the social difficulty comes the pathologic character of the lesion. For small, limited new lesions situated in the upper part of the lung, a selective pneumolysis may be better tolerated than would an extensive extrapleural procedure. I have succeeded in persuading our phthisiologists to accept this important principle. In cases of bilateral tuberculosis, on the other hand, if the vital capacity is insufficient for an extensive collapse, the latter method is the treatment of choice, because of its selectivity.

In the presence of a limited lesion, even with an adhesive pleura, one must not forget that the mediastinum may be labile and so may yield to the pressure obtained. The surgeon cannot always guarantee the volume of the space opened; also, after operation, the space may grow wider because of changes in the rhythm and tension of respiratory movements and also under the pressure of the liquid taken in. Owing to this increase in the space, mediastinal deviations may take place. I have not encountered "flutters" like those observed after plastic procedures. The surgeon may sometimes be surprised to find, in later controls, a space as wide as that referable to the intrapleural pneumothorax. With a dyspneic patient, after a short period, one must keep this complication in mind.

When large, thick-walled and fibrotic cavities are present and there is heavy infiltration of the surrounding tissue the results are always poor. In most such cases, separation of the pleural from the fascia demands great skill and cannot be done within the limits of safety, nor will the collapse be established in the manner desired. Many complications, therefore, are likely to occur. During the postoperative period one can see the cavity at the base of the space unchanged, or rather deformed. The clinical signs may be altered, but the sputum continues to give a positive reaction for Koch's bacillus. Under these circumstances, continued insufflations are valueless and create an unfavorable opinion of the procedure.

When my associates a
treatment to patients

mothorax we observed that the physicians delivered these patients to the surgical clinic after a long period of insufflations. Of course, the time that had elapsed was sufficient to thicken the pleural fascia. The thickened pleura always loses its elasticity and is likely to be torn or punctured by negative pressure during the operation. In the second stage, with the resulting tear present, high pressure cannot be maintained in the open space; also, the thickened pleura does not yield properly to pressure, and therefore the desired collapse may not be obtained even by subsequent reinflations. In such a case, if the pneumothorax was indicated for a lesion situated in the upper lung field, we advise the treating physician to abandon it before sending the patient to be operated on. In some patients with extensive lesions one may try to combine the two spaces by means of a wide incision. My experience does not lead me to favor the last-mentioned method. The negative pressure of the intrapleural space always neutralizes the positive pressure one desires to produce by reinflation. Then the newly separated parietal pleura, under this influence and because of the alternate expansion, readheres to the fascia, which results in closure of the extrapleural space.

In cases of bilateral disease the opposite lung must be taken under control by pneumothorax. One is not always able to control the other side, because extensive pleuritis may make it impossible. Without this control, however, the surgeon cannot be optimistic about the operative results.

From the foregoing observations one may conclude that the success of the treatment depends to a great extent on the accuracy of the range of indications. With my growing experience I was obliged to alter this range. To the condition of the lesion, its volume, extent, duration, anatomicopathologic character and position I began to add the social and economic status of the patient, his place of residence, his or her sex (I prefer the female for this procedure), and his age (children and old persons are preferable) as relative indications. The range of indications, therefore, may be summarized as follows:

1. New infections with thin-walled cavities measuring less than 4 by 4 cm.
2. Fibrotic cavities measuring less than 4 by 4 cm.
3. New infections with cavities measuring more than 4 by 4 cm.

As I widened the range I also operated on

4. Patients with fibrotic cavities measuring more than 4 by 4 cm.
5. Patients with unilateral extensive caseopneumonic lesions.
6. Patients with bilateral infection.

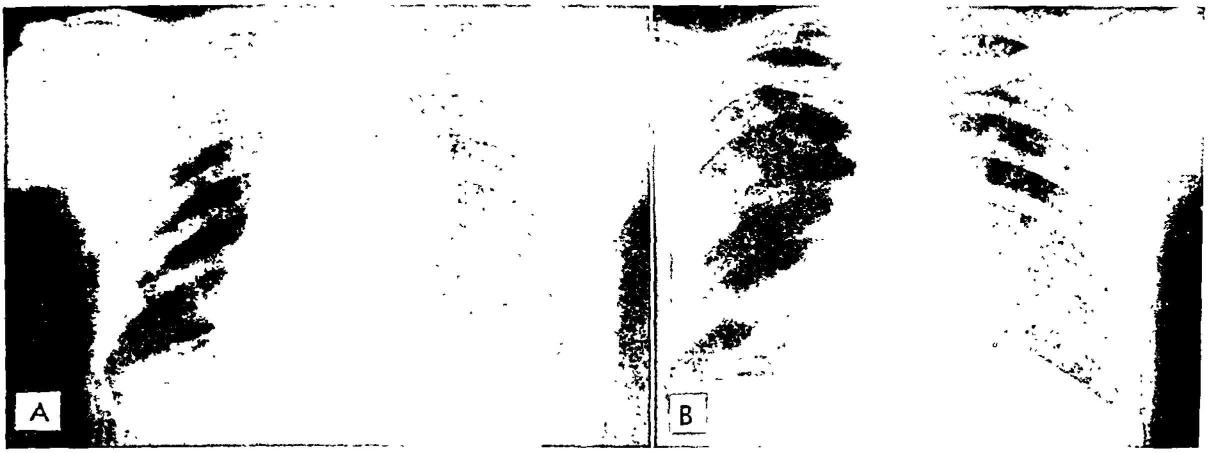

Fig. 2 (Case 2).—Mr. N. S., aged 22. *A*, fibrotic old cavitary tuberculous lesion at left upper lobe. *B*, same patient. After apicolysis and pneumothorax a satisfactory air chamber was obtained. Sputum normal. (Roentgenograms reversed; read left for right and vice versa.)

7. Patients with giant cavities (especially if in the upper lung field).

To prepare the patient for operation, I generally give him shots of streptomycin, 0.5 Gm. daily for three days. This I consider a worth-while procedure to prevent dissemination.

Toxic patients with anemia and in bad general condition are given blood transfusions before and during the operation. All of them react favorably.

I prefer to operate with the patient under general anesthesia. I performed 100 operations with nitrous oxide–oxygen, 35 with kemital-sodium and 14 with a combination of the two. All were satisfactory, and I did not encounter any disadvantage.

I prefer a short incision in the paravertebral space. In 2 cases I made it by the anterior approach, following the direction of the fourth rib, but found it disadvantageous for pneumolysis. Although the point of entry depends on the location of the lesion, in a great number of cases I resected the fourth rib and, rarely, the sixth. In 6 cases, instead of resecting, I entered through the fifth intercostal space and found it remarkably advantageous. In fact, this approach shortened the operating time, and all operations in which I employed it were performed as easily as with resection.

Before closure I injected a solution, here called streptocillin which contains 1 Gm. of streptomycin and 1,000,000 units of penicillin, into the space. At first I thought it advisable to drain the space, and in 3 cases used elastic tubes. Even when I left them not more than forty-eight hours they did not prevent the occurrence of complications, so I discontinued drainage. To check postoperative bleeding I used locally, in 1 group of cases, such hemostatic preparations as topostassine, coagulene, serum or gelatin, but no significant effect was observed.

Postoperatively I employed (1) blood transfusions when required for excessive bleeding; (2) penicillin therapy for two or three days; (3) aspiration (on the third day) of the sanguineous liquid accumulated in the space, with initiation of insufflations, and (4) injections of streptocillin directly into the space. Aspiration of the liquid must be done methodically, or the fluid may coagulate and even organize, leaving a narrow and valueless space (Sevim Ajur).

The age and sex incidence of the series of 150 patients, 95 male and 55 female, may be tabulated as follows:

| Age, years | 14-20 | 21-30 | 31-40 | 41-50 |
|---|---|---|---|---|
| No. of patients | 37 | 76 | 25 | 12 |

Pathologically the lesions were classified thus:

| | |
|---|---|
| Small new cavity | 15 |
| Small fibrotic cavity | 60 |
| Large fibrotic cavity | 75 |

Twenty-four patients had bilateral le-

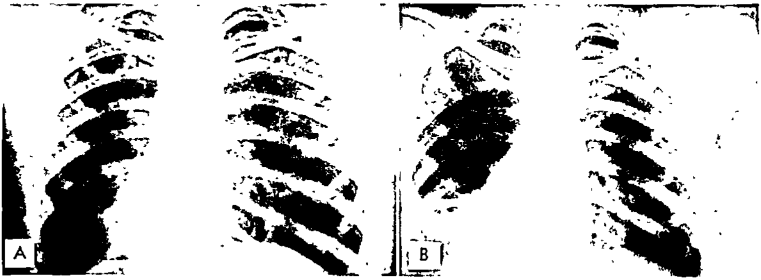

Fig. 3 (Case 3).—Mr. H. A., aged 25. *A*, left solitary fibrotic-walled apical cavity. , aft extrapleural apicolysis and pneumothorax. Very large separation made and com (Roentgenograms reversed; read left for right and vice

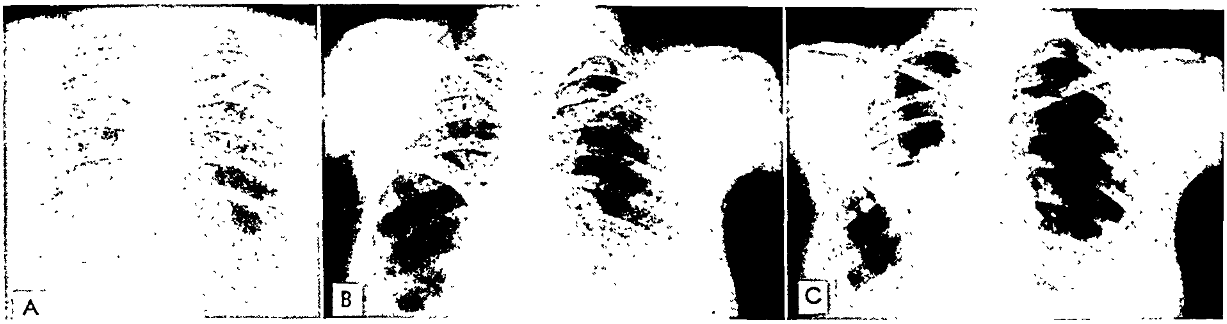

Fig. 4 (Case 4).—Miss B. E., aged 20. *A*, early cavitary tuberculosis of left upper lobe. *B*, film taken after pneumothorax, which failed. Cavity is still visible on the air pocket. *C*, after operation. Cavity has been collapsed by combination of extrapneumothorax and intrapneumothorax. (Roentgenograms reversed; read left for right and vice versa.)

sions. In 5 of them pneumothorax had been established previously on the opposite side. In the remaining 19 the localized and even the extensive lesions were uncontrolled. In 22 patients with partial pneumothorax which had had no effect on the lesion of the upper lung field I combined the two spaces. I was able to maintain the two spaces in 3. In the remainder the extrapleural space was sufficient for collapse and, relying on this effect, I discontinued the intrapleural pneumothorax. My opinion is that it is nonsense to insist on continuing the collapse of healthy portions of the lung.

Finally, to make an adequate analysis of the operations, I classified them, as regards indications, into two groups. The first group consisted of 75 cases in which isolated cavities (new or fibrotic) were situated in the upper portion of the lung. Each of the patients in this group underwent classic extrapleural pneumolysis. In postoperative controls the diseased portion of the lung was observed to be thoroughly collapsed. Complications had not occurred, and the bloody fluid that accumulated had disappeared after a few aspirations. In some cases no fluid accumulates (Sayim Oz; Aycha Kirtulan).

All of the patients left the hospital in less than one month. The sputum of 9 patients continued to give positive results. In 5 of these the disease was bilateral, and after the same operation had been performed on the opposite side the reaction of the sputum became negative. In the 4 others, who had unilateral disease, the lesions were observed again after a short period, and I was obliged later to perform thoracoplasty on 3 of them (1 refused). The bacilli disappeared subsequently. After six months 1 of these patients returned with a new extensive lesion of the caseous pneumonic type in the opposite lung and died of profuse hemoptysis To draw an accurate picture of the results, 89 per cent of the patients

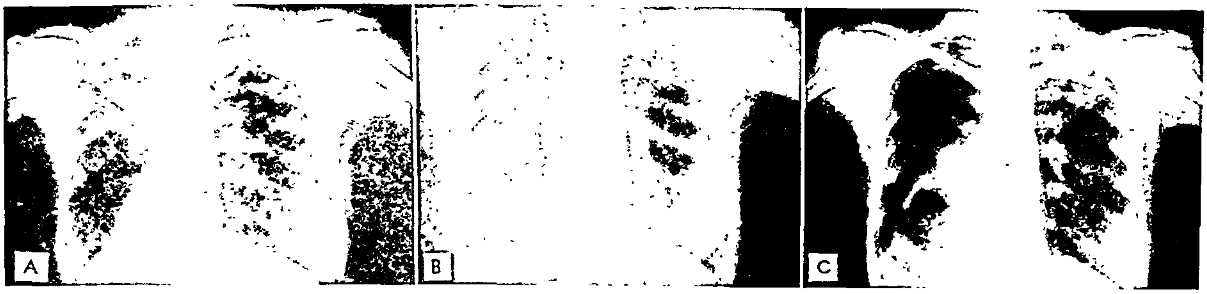

Fig. 5 (Case 5).—Miss S. C., aged 30. *A*, left upper lobe showing old cavitary tuberculosis. *B*, pneumothorax was begun and failed. *C*, satisfactory collapse after apicolysis and pneumothorax obtained by combined extrapleural pneumothorax and intrapleural pneumothorax. (Roentgenograms reversed; read left for right and vice versa.)

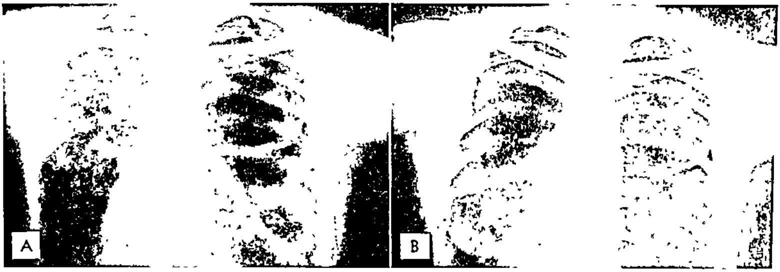

Fig. 6 (Case 6).—D. G., aged 30. *A*, bilateral fibrocaseose lesion. Right side under pneumothorax treatment. Pneumothorax was attempted on left side, but failed. *B*, left extrapleural apicolysis performed and satisfactory collapse obtained. (Roentgenograms reversed; read left for right and vice versa.)

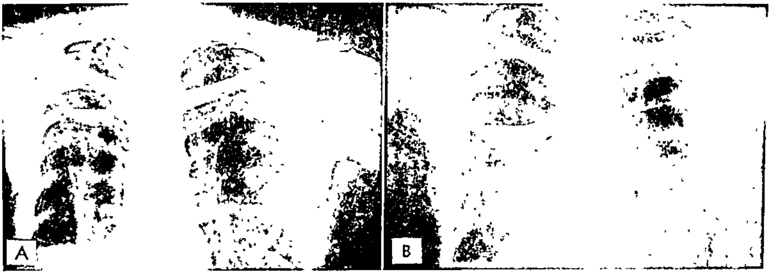

Fig. 7 (Case 7).—Mr. K. V., aged 32. *A*, large fibrotic walled cavity in left upper lobe, with ineffective pneumothorax. *B*, satisfactory collapse obtained after apicolysis and pneumothorax. (Roentgenograms reversed; read left for right and vice versa.)

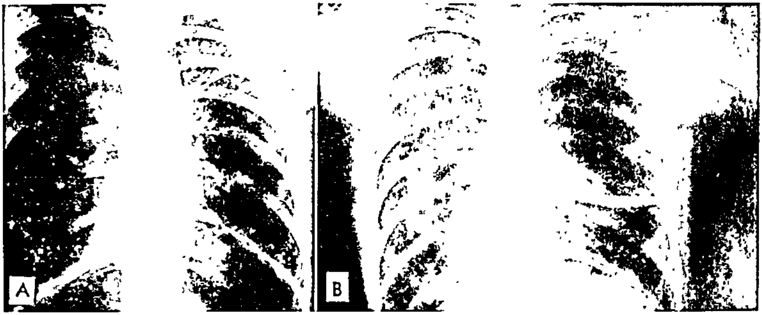

Fig. 8 (Case 8).—Mr. M. E. *A*, old cavity on right side, located close to periphery. *B*, film taken after operation. Very large separation made and good result obtained. Separation made without any rib resection. (Roentgenograms reversed; read left for right and vice versa.)

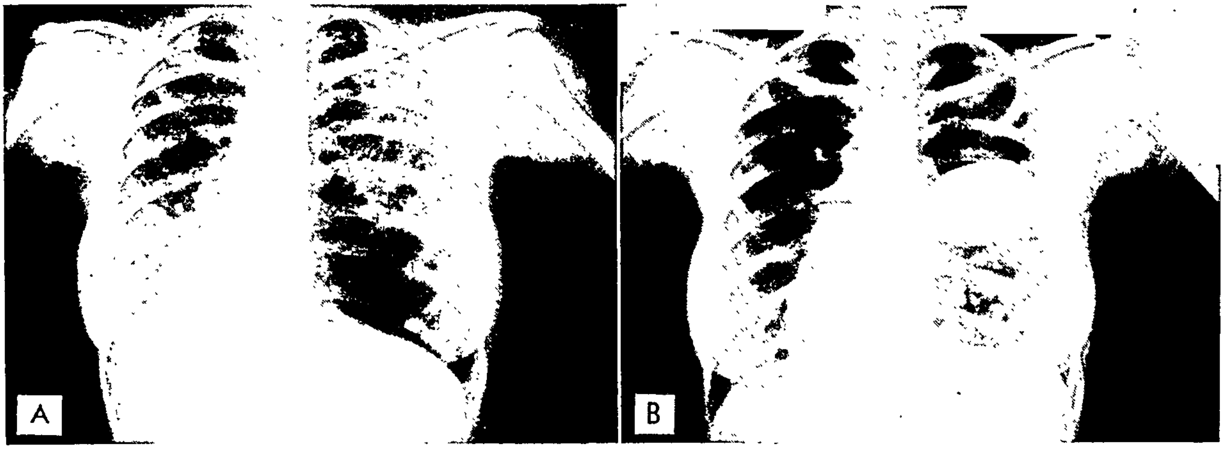

Fig. 9 (Case 9).—Miss S. A., aged 16. *A*, recent lesion of right upper lobe with small cavities. Pneumothorax was attempted but failed. Many adhesions prevented collapse. *B*, good collapse obtained after extrapleural apicolysis and pneumothorax. Fibrinous accumulation is visible in bottom of chamber. (Roentgenograms reversed; read left for right and vice versa.)

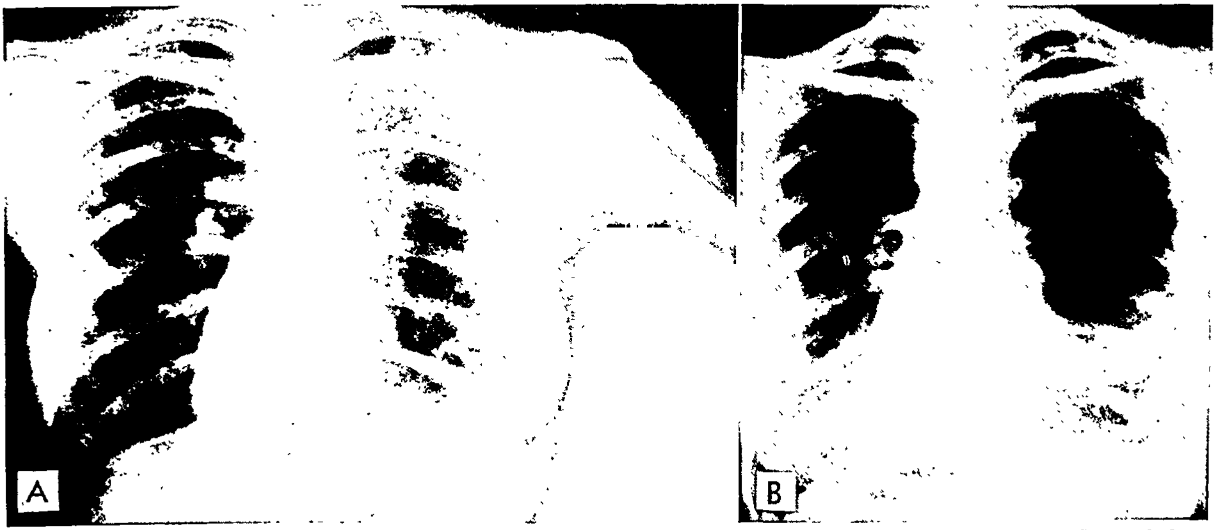

Fig. 10 (Case 10).—Miss S. O., aged 20. *A*, right fibrocaseose lesion about one year old. *B*, satisfactory collapse obtained after extrapleural apicolysis and pneumothorax. (Roentgenograms reversed; read left for right and vice versa.)

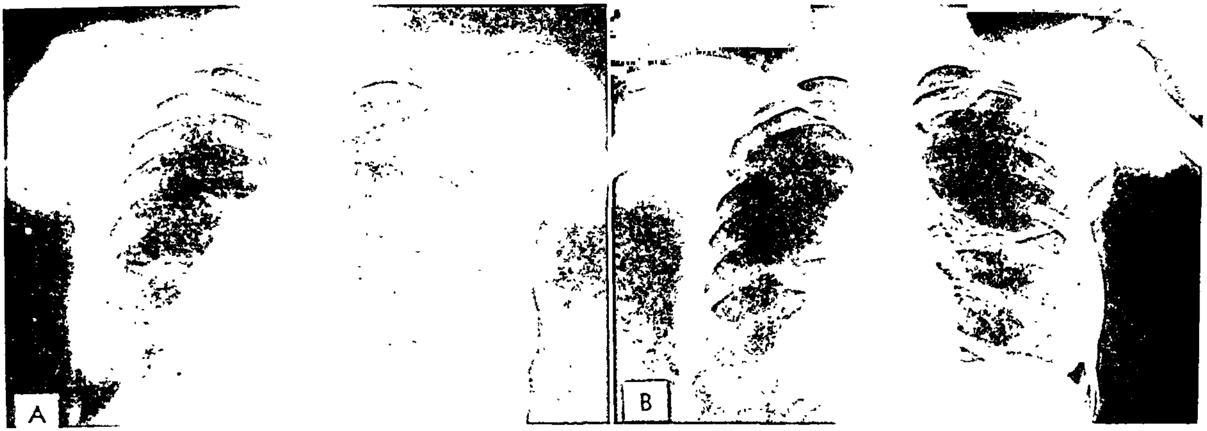

Fig. 11 (Case 11).—Miss A. K., aged 28. *A*, bilateral extrapleural pneumothorax under consideration. *B*, good double collapse obtained after bilateral extrapleural apicolysis and pneumothorax. Patient is considered cured. (Roentgenograms reversed; read left for right and vice versa.)

must be regarded as clinically cured and 10 per cent only improved.

The second group was composed of patients who were at first not considered suitable for this procedure but on whom, after the range of indications had been widened, the operation was nevertheless performed. These patients had large fibrotic cavities; in some of them the cavities were nearly peripheral. Even with 50 patients cured (71.5 per cent), the results were not sufficiently encouraging. Yet they were certainly not bad, because the cured patients maintained their good condition; in subsequent checkups I found them free from complications. It is surely justifiable, therefore, to conclude that the method offers promise for the future.

The patients are treated by inflation at different sanatoriums. I check up regularly and have noted that the amount of air given varies between 100 and 200 cc., according to the condition of the spaces, and the intervals between inflations do not exceed one month. From time to time serofibrinous liquid has accumulated, but this has vanished quickly. In 2 patients it has persisted for a year and a half but, to my surprise, has remained sterile. *Three patients died within a short time* after the operation (4.3 per cent). The first had a fatal hemorrhage. At necropsy, although the vessels in the neighborhood were observed to be intact, the extrapleural space was full of coagulated blood. The second died in a fortnight from secondary infection. The third went into surgical shock and died on the second

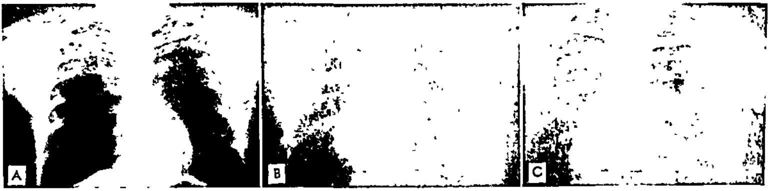

Fig. 12 (Case 12).—Mr. A. O., aged 28. *A*, bilateral fibrocaseose lesion; larger on right than on left. *B*, extrapleural pneumothorax on right side leaves sputum still productive. *C*, extrapleural pneumothorax performed on left side; sputum became sterile. (Roentgenograms reversed; read left for right and vice versa.)

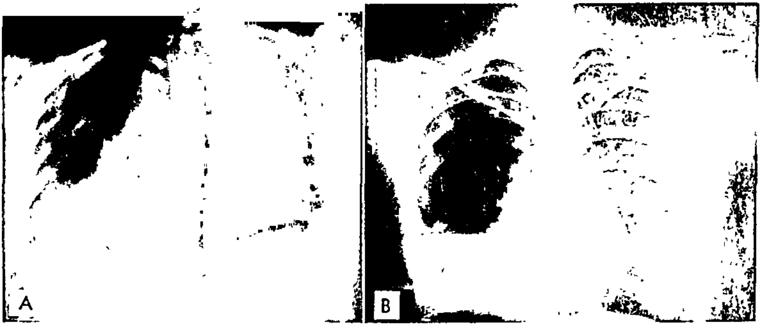

Fig. 13 (Case 13).—Miss M. S., aged 21. *A*, tomogram showing large cavity in left upper lobe. *B* good collapse obtained by large postoperative separation. (Roentgenograms rev[illegible] left fo right and vice versa.)

postoperative day. In 4 (5.7 per cent) of the surviving patients pleuropulmonary fistulas were encountered. They had had large peripheral cavities with fibrotic walls and adherent lung tissue. Separation of the parietal pleura was achieved poorly, and a considerable amount of fluid accumulated in the space. In 3 patients (4.2 per cent) extrapleural empyema developed. These are still under treatment, and, despite this serious complication, their general condition is improved. Later control studies have revealed the lesions unchanged in 7 cases, and I have been obliged to perform plastic operations (10 per cent). Three patients (4.2 per cent) have died lately from reactivation of the formerly arrested lesion in the opposite lung.

The results in the second group, therefore, may be summarized as follows:

| Cure | Death | Perforation | Empyema | Plastic Operation Required |
|---|---|---|---|---|
| 58 | 3 | 4 | 3 | 7 |

It is obvious from all this that even in such inconvenient and unsuitable circumstances, with the patient's condition otherwise nearly hopeless, a great many of the lesions were arrested and even improved.

In general, the end results for the two groups may be classified as follows:

| Cure | Complications | Death |
|---|---|---|
| 129 | 18 | 3 |

With regard to the results of the 150 operations performed by myself during the past two and one-half years the following conclusions have been reached:

1. Pneumothorax, which for a time was more or less out of favor, is now carried out so much more successfully that it can replace thoracoplasty in more cases than was formerly thought possible.
2. The treatment requires good technic as well as continuous and skillful medical supervision.
3. Well-planned medicosurgical cooperation is necessary in selecting the cases and also in treating any complications that may arise in the second stage.

### RÉSUMÉ

Voici les conclusions de l'auteur basées sur 150 opérés durant une période 2½ ans.

1. Le pneumothorax, qui a connu une vogue plus ou moins marquée, revient maintenant de plus en plus et remplace la thorocoplastie de façon avantageuse là où autrefois, on n'onsait pas l'utiliser.
2. Le traitement demande une bonne technique et une surveillance médicale attentive.
3. Il faut nécessairement une collaboration médico-chirurgicale pour le choix des cas et l'application du traitement afin de mieux traiter les complications du deuxième stage.

### SCHLUSSFOLGERUNGEN

Der Verfasser gelangt auf Grund der Ergebnisse von 150 von ihm während der letzten zweieinhalb Jahre ausgeführten Operationen zu den folgenden Schlussfolgerungen:

1. Der Pneumothorax, der zeitweilig mehr oder weniger in Ungnade gefallen war, kann heutzutage mit so viel grösserem Erfolg als früher ausgeführt werden, dass er die Thorakoplastik häufiger ersetzen kann, als man für möglich gehalten hatte.
2. Die Behandlung erfordert sowohl gute Technik als auch ständige und fachkundige medizinische Uberwachung.
3. Zur Auswahl der Fälle und zur Behandlung von Komplikationen, die im zweiten Stadium auftreten können, ist eine gut geplante medizinisch-chirurgische Zusammenarbeit erforderlich.

### CONCLUSIONI

Sulla base di 150 interventi eseguiti in 2 anni e mezzo, l'autore conclude che:

1. Il pneumotorace, che per qualche tempo era stato messo in disparte, viene ora eseguito di nuovo con successi sempre maggiori così da poter sostituire la toracoplastica in un numero di casi maggiore di quanto non si credesse in seguito.
2. La cura richiede una tecnica accurata e un controllo continuo e attento.

3. E' necessario un accordo medico-chirurgico per scegliere i casi e per trattare le complicazioni che possono sopravvenire.

### CONCLUSIONES

Se llega a las siguientes conclusiones, en relación con los resultados de 150 operaciones practicadas por el autor durante el año y medio préximo pasado:

1. El neumotórax que por algun tiempo fué más ó menos favorecido se lleva a cabo actualmente con mayor éxito pudiendo substituir a la toracoplastía en mayor número de casos de losque se pensaron anteriormente posibles.
2. El tratamiento requiere una buena técnica, así como una experta y continua supervisión médica.
3. Un cooperación médico - quirúrgica bien planeada es necesaría en la selección de casos, así como en el tratamiento de cualquier complicación que pueda surgir en el segundo período.

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It is more easy to get a favor from fortune than to keep it.
—*Publilius Syrus*

Fortune dreads the brave, and is only terrible to the coward.
—*Seneca*

Fortune brings in some boats that are not steer'd.
—*Shakespeare*

Fortune does not change men; it unmasks them.
—*Mme. Necker*

Fortune is like glass—the brighter the glitter, the more easily broken.
—*Publilius Syrus*

Reflect upon your present blessings of which every man has many; not on your past misfortunes, of which all men have some.
—*Dickens*

# Rehabilitation of Patients with Spastic Paralysis

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IT is the purpose of this presentation to offer certain intrinsic neuromuscular responses for the consideration of the orthopedic specialist who is interested in corrective therapy and rehabilitation.

The discussion will be limited to the spastic types of paralysis of infancy, childhood and the adult years of life. Types of rigidity and dystonia will be mentioned only to exclude them by the differential means of diagnosis now at hand. The treatment of these three conditions is quite different, and they should, therefore, not be mistaken or confused if satisfactory levels of rehabilitation are to be obtained.

In the last analysis, the problem of spastic paralysis, with its *contraction* and *contracture* deformities, is primarily neurologic, and it is high time that the neurologist gave some aid to the orthopedist, who has carried the burden of these chronic states for so many years.

After a prolonged and careful study of the origin of human movement, it is now possible to obtain certain advantages from retained *normal* and *pathologic reflexes* that have not heretofore been called upon to do their share in the therapy of rehabilitation. These are the well-known reflexes of spastic forms of paralysis which are intrinsic to the cord and obtained through superficial and deep peripheral stimuli.

In other words, instead of the therapist's expending effort on passive or routine exercise of the muscles of the trunk and extremities, this exercise can be obtained by making various selected reflex arcs do the active work in their own way (which proves to be superior) and with it gain not only the activity phase of muscle contraction but the beneficial coincident effects of vasomotor response and the intrinsic values of muscle volume and strength. It has become a simple form of therapy and has led to the integration of certain of these simple reflex responses into a spreading and coordinate type of movement which, with other reflex augmentation, produces a typical amphibian pattern of progression, an extremity response that underlies all of the human walking components.

It is clear, from the "tonic neck reflex" to the mass reaction of defense or the postural reflex (Marie-Foix), that spastic man is but a reflex robot, with loss of voluntary control; nevertheless, he can put on a powerful act at the amphibian level if properly timed and sequenced in serialized patterns of progression (belly down) without a cortical motor area. With a properly devised motor end point stimulator, rigged like an automobile commutator, sequence may be made to simulate the walking gait. This proved to be valuable with several paraplegic patients.

This all adds up to the fact that crude walking, feeding and self-care patterns of movement remain in the human being to be exploited after loss of the higher voluntary levels, and these can be trained for the purpose of released spasticity, coordinate movement and useful purposes if one reenacts the type of movement for which they were designed four hundred million years ago.

One must not forget that the amphibian-reptile vertebrates walked with their type of extremities long before the pallial hemispheric masses developed in the mammal and in man. This great higher brain mass (which we have so long worshiped) serves its purpose in the form of motor *skills* that arose with fingers, stereoscopic vision and the two-footed upright posture with arms and hands free to act.

Some of the values of the normal and

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pathologic reflex response in training and the "unlooking" reflexes which are reciprocal modifiers for the spastic tone that has so often led to contraction deformity, if this is prevented in its early stages by proper postural and pattern activity utilizing the lower level controls of the nervous system, it may do much to aid the orthopedic specialist in the correctional measures to be eventually employed.

"Unlocking reflexes" refer to positions and movements of the neck or extremities which cause automatic release or relaxation of hypertonic (spastic) muscles or muscle groups.

*The sensory component of the "unlocking reflex"* apparently chiefly concerns posture and joint position, as well as muscle stretch augmented by peripheral resistence against the parts involved.

My studies on the origin of human movement indicate this phenomenon is not a simple single muscle response but concerns the automatic release of groups of muscle conceived with a primitive "pattern of movement," originally with the purpose of projecting the trunk forward as an act of progression.

Familiar simple tendon and superficial "reflex" response play a subordinate role to the higher integration of "mass reaction" activity, which in time sequence just precedes a purposeful act.

To obtain and apply these "unlocking" responses to the spastic types of paralysis, the following concept must be carefully simulated and effected:

The patient must be placed in the prone position with chin (mouth) in the midline. This establishes the postural-vestibular values of the early vertebrate types (fish-amphibian) upon which all so-called reflex mechanisms "normal" or "pathological" have been established.

The rotation and slight lateral flexion of the head from side to side in a ventral arc (tonic neck reflex) initiates homolateral forward movement of the extremities on the side toward which the oral structure is turned, and at the same time "unlocks" or reciprocally relaxes the contralateral components.

This original eye-head-neck component "sequentially conditions" the *power flow* to follow in the presenting parts, initiating ventral projection forward of the body mass as well as "unlocking" preparations for the next phase of the progression cycle.

In the evolutionary time scale this represents 450,000,000 years of neuromuscular response (fish) arising from the reticular mass at the level of the aqueduct of Sylvius.

Patterns of movement that followed this initial integration with evolution of the extremity structures established the homolateral sequence of patterns emerging throughout the era of amphibian life.

The "unlocking" postural movement sequence follows in shoulder-arm-forearm-hand and fingers sequence as the part is swept in a two-dimensional downward and backward thrust against peripheral resistance (water-mud-earth). This was originally designed to accomplish projection, as the head turned toward the contralateral advancing side.

The next level of evolutionary advancement (reptile-turtle), brought three-dimensional antigravity postural mechanisms into "off the ground" integration of movement. Joint and antigravity postural mechanisms became involved.

For instance, to "unlock" a spastic arm and forearm, the patient is placed in the prone position, head-neck turned *away* from the part, elbow elevated to the shoulder level and flexed 90 degrees. The hand and wrist are drawn *down, under* and slightly outward from the elevated arm position, the humerus being rotated 30 degrees (turtle type). The spastic biceps automatically relaxes ("unlocks") when the extremity has accomplished approximately 130 degrees of lateral arc.

The "unlocking reflex" of the wrist and hand occurs as the part (palm up) completes the 180 degree thrust to a position almost above the buttocks.

The "unlocking reflex" of the spastic fingers is accomplished in this position by adducting the thumb to an opposable position.

Voluntary movement [illegible] a. [illegible]nger.

may now appear in this relaxed position if proper efforts are made by the patient (*provided* the thumb is brought into an apposable position to the middle finger by use of the phalangeal-metacarpal joint ("unlocking reflex of fingers with extension").

The proper appositional position of the thumb is required before a "purposeful" prehensile act can be initiated.

Higher levels apparently do not offer functional response until posture is correct for *purpose* (picking up or holding an object in the fingers).

Because the head and eyes are turned away from the hand (in the palm-up over the buttocks position of relaxation), two mirrors are required to train the patient in visual reinforcement of attempts to "capture," correlate and use whatever finger movements remain and are obtainable. These efforts have made possible self-feeding and other crude skills in the majority of subacute or chronic types of spastic patients.

It is obvious that, as these movements arise at primitive levels at or below the reticular pons, pathologic change involving higher levels and the cortex (common stroke) do not affect them except as to voluntary higher mammal-man types of skills and coordination.

Reflex and "unlocking reflex" activity can then be "conditioned" and established in useful forms of integration at the crude primitive levels of motor expression. Skillful use of the fingers and hand (cortical) cannot be reestablished unless the higher levels are intact. Prehensile grasp and feeding movement, however, can be accomplished with proper training if lower primitive levels are functioning. A valuable aid to rehabilitation is, therefore, available.

This brief account will indicate the usefulness of common reflexes for initiating primitive patterns of movement and reciprocal "unlocking" responses that occur coincidentally. Both factors are of great value in programs of physical therapy and rehabilitation.

The same factors are present in the lower extremities, although the sacral bulb is apparently a more self-organized unit under associated control and coordination.

The "unlocking" sequence of the trunk and lower extremities follows those of the upper a fraction of a second later. The same trunk projection purpose is involved.

Flexion of the toes at the phalangeal metatarsal joint produces a "withdrawal," "mass reaction" or "supporting reflex" with flexion and abduction ("unlocks" the extensors and adductors), Babinski, Chadduck reflex unlocks, fanning and extension of toes and flexion of the ankle; prolonged ankle clonus gives intrinsic exercise to the calf muscles, etc.

Properly timed, coordinated and conditioned use of these "reflexes" in conjunction with the tonic neck reflex sequence makes semiautomatic crawling and later walking possible. Relaxation of spastic tone ensues for the benefit of the therapist and patient.

Utilization of "normal" and "pathologic" reflexes (inherited from evolutionary patterns of movement) with their "unlocking" reciprocal components under proper posture and sequence have been of great therapeutic and rehabilitation value in spastic types of paralysis observed in man.

## SUMMARY

The author describes certain intrinsic neuromuscular responses that can be used to advantage in the rehabilitation of patients with spastic paralysis. It is pointed out that the problem of spastic paralysis is primarily neurologic and that the orthopedist is in need of the neurologist's cooperation.

The responses concerned are well-known reflexes associated with spastic paralysis, intrinsic to the cord and obtained by means of superficial and deep peripheral stimuli. In the author's opinion, employment of these reflexes will produce better results than those observed after treatment by passive exercise. Even after loss of the higher voluntary levels, crude patterns of movement remain in the hu-

man being, and these can be trained to obtain released spasticity, coordinate movement and useful activity.

### RÉSUMÉ

L'auteur décrit certaines réactions neuro-musculaires intrinsèques qui peuvent être utilisées pour le traitement des patients atteints de paraplégie spastique. Il est souligné que la thérapeutique de la paralysie spastique est avant tout neurologique et que l'orthopédiste a besoin de coopérer avec le neurologue.

Les réflexes de la paralysie spastique sont bien connus et sont obtenus, en passant par la moelle, au moyen d'excitations superficielles ou profondes. D'après l'auteur, l'utilisation de ces réflexes procurent des résultats meilleurs que ceux observés après traitement par exercice passif. Même après la perte des centres les plus élevés, des ébauches de mouvements restent dans l'organisme; ils provoquent, par l'entraînement, une spasticité modérée, des mouvements coordonnés et une utile activité.

### ZUSAMMENFASSUNG

Der Verfasser beschreibt gewisse neuromuskuläre Reaktionen, die man vorteilhaft zur Wiederherstellung von Kranken mit spastischen Lähmungen ausnützen kann. Er betont, dass die spastische Lähmung in erster Linie ein neurologisches Problem darstellt, und dass der Orthopäde auf die Unterstützung des Neurologen nicht verzichten kann.

Bei den erörterten neuromuskulären Reaktionen handelt es sich um wohlbekannte bei der spastischen Lähmung vorkommende Reflexe, die dem Rückenmark angehören und mittels oberflächlicher und tiefer peripherer Reize ausgelöst werden. Die Heranziehung dieser Reflexe ergibt nach Ansicht des Verfassers bessere Ergebnisse, als nach Behandlung mit passiven Übungen beobachtet werden. Gewisse grobe Bewegungsmechanismen bleiben beim Menschen selbst nach Verlust höher gelegener willkürlicher Zentren erhalten, und wenn diese trainiert werden, lässt sich eine Erschlaffung der Spastizität, Koordination der Bewegung und nützliche Aktivität erreichen.

### RIASSUNTO

L'autore descrive alcuni riflessi neuromuscolari di natura intrinseca, utili ai fini della riabilitazione di pazienti affetti da paralisi spastiche. Si sottolinea il fatto che il problema della paralisi è sopratutto d'ordine neurologico, cosicchè all'ortopedico è indispensabile la collaborazione del neurologo. I riflessi in questione sono notoriamente associati con la paralisi spastica, e si possono ottenere a mezzo di stimoli periferici superficiali e profondi. L'autore pensa che la provocazione di tali riflessi possa dare risultati migliori di quanto solitamente si ottiene con la chinesiterapia. Anche dopo la perdita della possibilità di movimento attivo, nel corpo umano restano le vie di trasmissione e queste possono essere utilizzate allo scopo di ottenere la remissione della paralisi spastica, movimenti coordinati ed una utile attività.

### RESUMEN

El autor describe ciertas respuestas neuromusculares intrínsecas que pueden usarse con ciertas ventajas en la rehabilitación de pacientes con parálisis espástica. Se señala que el problema de la parálisis espástica es primordialmente neurológico y que el otropedista requiere la cooperación del neurólogo.

Las respuestas concernientes son refelejos bien conocidos que se presentan con la parálsisiespástica, medulares intrínsecos y obtenibles por estímulos periféricos superficiales y profundos. En la opinión del autor el uso de estos reflejos producirá mejores resultados que los que se obtienen por los tratamientos de ejercicios pasivos. Aun después de la pérdida voluntaria de los niveles superiores permanecen ciertos movimientos que ejercitándose pueden mejorar la espasticidad, coordinar el movimiento y redundar en actividad útil.

# Subacute Disseminated Lupus Erythematosus and Uneventful Pregnancy

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THE current major publications dealing with obstetrics make little or no reference to the effect of pregnancy on lupus erythematosus. The few cases reported present conflicting results.

Crawford and Leeper[1] reported 3 pregnancies associated with local discoid lupus erythematosus. One patient became worse during pregnancy and improved greatly one month post partum; in another the disease became systemic and she died one day post partum, though the infant survived; the third was delivered of a stillborn fetus during the eighth month of gestation and remained alive for five years, after which time she succumbed to an acute exacerbation of disseminated lupus erythematosus.

Ellis and Bereston[2] treated 3 patients with acute disseminated lupus erythematosus complicated by pregnancy. None of these women and none of their infants survived. These authors reviewed the literature up to 1952 and also summarized the reports they obtained by questionnaire from 280 dermatologists. Of 56 patients with acute lupus erythematosus, 14 died and 11 became worse during pregnancy. Of the 13 patients with subacute lupus, 6 had spontaneous abortions, 3 became worse and 7 improved during pregnancy. Thirty-one patients with chronic discoid lupus were not affected by pregnancy.

Recently we had the opportunity to observe an uneventful pregnancy in a patient with subacute disseminated lupus erythematosus who had two severe acute exacerbations of the systemic disease within six months before the onset of gestation.

### REPORT OF CASE

Mrs. G. B., a white roentgen laboratory technician 21 years old, presented herself to one of us (E. K.) on April 7, 1951, with complaints of pain and swelling of the ankles and knee joints, generalized pain and swelling of the hands, fever and general body ache of three years' duration. The symptoms were intermittent and became worse during the summer. Pain in the left calf had begun about one year earlier and had become worse during the past three weeks, during which time a classic butterfly rash had appeared. Previous medical care had been directed toward treatment of arthritis, rheumatism, virus disease and infection of the kidneys. Otherwise the history was essentially normal.

She was admitted to Mount Sinai Hospital the next day. The blood pressure, pulse rate and respiratory rate were normal; the oral temperature was 99.6 F. The face presented symmetric, sharply defined scaly patches, varying in configuration, over the malar prominences and the eyelids. The heart had a soft blowing systolic murmur limited to the apex. The lungs and abdomen were normal. Tenderness was elicited over the muscles of the left calf, and tenderness and swelling over the left metacarpal-phalangeal joints. A few small, discrete lymph glands were observed in the right axilla and the submandibular region. Laboratory studies disclosed an erythrocyte count of 3,290,000 per cubic millimeter of blood, with 10.1 Gm. of hemoglobin, and a leukocyte count of 8,000 per cubic millimeter. The differential count was as follows: stab cells, 16 per cent; segmental cells, 54 per cent; lymphocytes, 28 per cent, and monocytes, 2 per cent. Kahn and Kline tests gave negative results. The sedimentation rate was 43 mm. per

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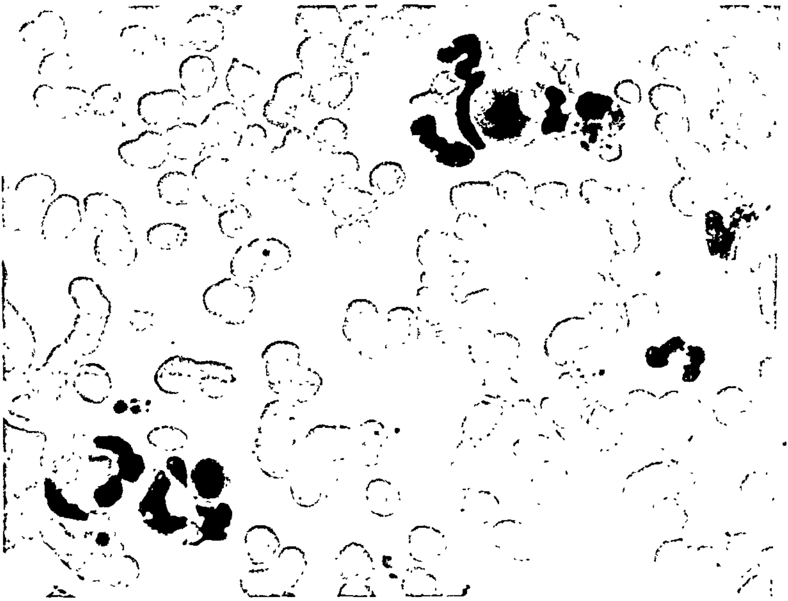

Peripheral blood smear illustrating cell characteristic of systemic lupus erythematosus.

hour. The blood chemical values, which included those for sugar, urea nitrogen, sodium, potassium, chlorides and carbon dioxide combining power, were within normal limits. The value for total proteins was 7.8 Gm., that for albumin 4.3 Gm. and that for globulin 3.5 Gm. per hundred cubic centimeters. A twenty-four hour urinalysis revealed a trace of albumin. The specific gravity of the urine was 1.012. Preparations of peripheral blood and bone marrow gave strongly positive reactions for lupus erythematosus. A thoracic roentgenogram and an electrocardiogram revealed no abnormality.

On completion of the aforementioned studies the patient was given 40 mg. of ACTH every six hours, 1 Gm. of potassium chloride three times a day, 2 pabalate tablets four times a day, a low sodium diet and supplemental vitamins. Whole blood (250 cc.) was administered twice. Within a few days the cutaneous eruption, the pain and swelling of the joints and the slight elevation of temperature subsided gradually and finally disappeared. The CBC also improved to normal range. ACTH was diminished to 25 mg. four times a day, and a change was finally made to cortisone in the same dosage. A flare-up of symptoms recurred and was controlled with an increase of cortisone to 30 mg. every six hours. The patient was released from the hospital with this dosage on April 29, 1951, twenty-two days after admission.

During the next fifteen months she
under constant observation, taking cort
in amounts varying from 45 to 125 mg. d
pabalate tablets, 4 daily, and potassium
ride, 15 gr. daily. The blood electrolytes
checked every month. Forty units of A
twice a week was ad or ad
stimulation.

The patient
September 19
comparable

pitalization, except that they were much more severe. In each instance she responded to large doses of cortisone, at times as high as 240 mg. daily. The dose of cortisone was gradually decreased to 50 mg. daily.

The first antepartum examination was done on March 14, 1953. The expected date of confinement was September 11. No significant facts were elicited from the family or past history other than those already mentioned. The menses began at the age of 14 and occurred at intervals of four and five weeks, with a moderate flow and no associated symptoms.

Examination revealed that the blood pressure in millimeters of mercury was 138 systolic and 80 diastolic, the pulse rate 82, and the weight 137½ pounds (62.4 Kg.). The eyes, ears, nose and throat were normal, as were the heart, lungs and breasts. There was a palpable abdominal mass 8 cm. above the symphysis pubis. Pelvic examination revealed a normal nulliparous introitus; the cervix was soft and slightly eroded; the corpus uteri was soft, anteflexed, freely mobile and enlarged to approximately the size of three months' gestation. The adnexae were normal. The pelvic measurements were within normal limits for a normal medium-sized gynecoid pelvis.

At this time patient was taking 50 mg. of cortisone, 15 gr. of potassium chloride and 250 mg. of ascorbic acid daily. A multiple vitamin compound was added to her diet, which was salt-free. She remained under the same management throughout her pregnancy. Her total weight gain was 2 pounds (0.9 Kg.). The B.P. never rose above 140 systolic and 90 diastolic, and the urine, blood picture and electrolytes remained normal at all times. The membranes ruptured spontaneously on September 2, 9 days before the due date, and the patient was admitted to the hospital. Labor began at 1:20 a.m. the next day, and at 4:15 a.m. a living female infant weighing 6 pounds and 7 ounces (3,919 Gm.) was delivered with the aid of a midline episiotomy and outlet forceps application. The third stage of labor and the postpartum course were uneventful. A repetition of the blood count and of the tests for blood chemical values and electrolytes gave normal results. Cell tests for lupus erythematosus gave weakly positive reactions. The patient was discharged from the hospital five days postpartum. When last seen, early in December 1953, both she and the baby were clinically well. The mother still has a rare lupus erythematosus cell in the peripheral blood. A preparation of the baby's peripheral blood gave negative results for this disease.

## COMMENT

Disseminated lupus erythematosus is invariably a fatal disease. With the introduction of ACTH and cortisone as therapeutic agents the disease may frequently be controlled. Crawford and Leeper[1] stated that pregnancy is not well tolerated by women with extensive lupus erythematosus. Ellis and Bereston[2] concluded that pregnancy does not affect the course of lupus erythematosus and that at no time should pregnancy be interrupted. Haserick[3] recommended that pregnancy be permitted if the patient enters a good steroid remission for one year prior to the onset of gestation.

Because of religious considerations our patient became pregnant two months after an acute exacerbation. Despite the short interval she had an uneventful course on a constant dosage of 50 mg. of cortisone daily. From the results in our case, it seems that, with the aid of cortisone and/or ACTH, patients with systemic subacute lupus erythematosus may go through pregnancy uneventfully.

## SUMMARY

1. A case of subacute disseminated lupus erythematosus complicated by pregnancy is presented.

2. Conception occurred approximately three months after an acute exacerbation of disseminated lupus erythematosus while the patient was being given a maintenance dose of 50 mg. of cortisone daily.

3. Gestation, labor and puerperium were uneventful.

4. The infant was not affected by the mother's disease, and at the time of writing the mother is still receiving 50 mg. of cortisone daily and is clinically well.

## RÉSUMÉ

1. L'auteur présente un cas de lupus érythémateux subaigu et disseminé, com-

pliqué par la grossesse.

2. La conception eut lieu approximativement trois mois après une crise aiguë de lupus érythémateux disséiné, alors que la malade recevait une dose continue de 50 *mg. de cortisone par jour.*

3. La grossesse, l'accouchement et les suites de l'accouchement ne présentèrent pas de complication.

4. L'enfant n'a pas été affecté par la maladie de sa mère, et au moment où l'auteur écrit cet article, la malade reçoit encore 50 mg. de cortisone par jour; son état est cliniquement satisfaisant.

### ZUSAMMENFASSUNG

1. Es wird über einen Fall von durch Schwangerschaft kompliziertem subakutem disseminiertem Lupus erythematosus berichtet.

2. Die Konzeption erfolgte etwa drei Monate nach akutem Aufflackern eines disseminierten Lupus erythematosus, während die Kranke sich auf einer kon*tinuierlichen Behandlungsdosis von 50 mg* Cortison pro Tag befand.

3. Schwangerschaft, Entbindung und Wochenbett verliefen ohne Zwischenfälle.

4. Das Kind war von der mütterlichen Erkrankung nicht befallen, und die Mutter befand sich zur Zeit der Niederschrift dieser Arbeit in gutem klinischen Zustand unter kontinuierlicher Fortführung der Cortisonverabreichung von 50 mg pro Tag.

### RESUMEN

1. Se comunica un caso de lupus eritematoso diseminado subagudo complicado por embarazo.

2. La concepción ocurrió tres meses después de una exacerbación de lupus eritematoso diseminado, cuando el paciente *estaba recibiendo una dosis de sostén de* 50 mg. de cortisona diarios.

3. La gestación, el parto y el puerperio fueron normales.

4. El niño no fué afectado por la enfermedad materna y en el momento de escribir este artículo la madre estaba recibiendo sus 50 mg. de cortisona diarios y se encontraba bien clínicamente.

### RIASSUNTO

1. Viene presentatoun caso di lupus disseminato eritematoso complicato da gravidanza.

2. La fecondazione avvenne circa 3 mesi *dopo una riacutizzazione del lupus, mentre* la paziente era in cura cortisonica (50 mg. di cortisone al giorno).

3. *Gravidanza, parto e puerperio furono* normali.

4. Il neonato non presentava alcuna malattia e, fino alla pubblicazione del lavoro, la madre stava bene e continuava la cura con il cortisone.

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I have lost everything, and I am so poor now that I really cannot afford to let anything worry me.
—*Joseph Jefferson*

Worry, the interest paid by those who borrow trouble.
—*George W. Lyon*

# The Importance of Cervical Lacerations in the Management of Habitual Abortions

## Report of a Case

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ONE is sometimes faced with the problem of women who have had a baby many years ago and who, in subsequent pregnancies, have failed to carry the conceptus to term, aborting at various stages of gestation. It is imperative to put these women through a complete sterility study, including a basal metabolism test, hystersalpingographic studies, endometrial biopsy and the Huhner test, to exclude all other factors that may have caused the repeated abortions. Occasionally one elicits the history of a previous difficult instrument delivery that resulted in deep unilateral or bilateral lacerations of the cervix. It is such cases that this paper is dealing with.

In checking the standard textbooks on gynecology and sterility, one searches in vain for the statement that lacerations of this type may be responsible for repeated spontaneous abortions. Yet, in foreign textbooks, references can be found to that effect. Halban[1] stated: "Of great importance are cervical lacerations, because the cervical canal gets excessively patent as pregnancy progresses and the lower pole of the ovum loses its necessary support. Those lacerations which extend by taut scars into the parametrium and the vagina are particularly troublesome, since the scars will exert a traction and thus irritation upon the uterus, which will result in contractions. Such lacerations are to be closed by the Emmet's operation." The same opinion was expressed by Martius.[2] It is interesting to note that Emmet's trachelorrhaphy has become obsolete in the United States during the past two decades, and has mostly been replaced by electrocauterization or conization of the cervix. Te Linde[3] stated, "In the past 10 years the author has performed a single trachelorrhaphy. The indication was a very deep cervical tear in a woman who had had several premature labors at about seven months. The deep laceration of the circular cervical musculature was thought to be a possible cause of the patient's inability to carry the child to term. Following the repair, the patient went to term with the next pregnancy." With these quotations in mind, the following case, in which the condition was similarly treated, is reported.

### REPORT OF CASE

Mrs. T. S., 28 years old, was first seen on Jan. 5, 1952, after having been referred by another physician because of habitual abortions. She stated that she had had a very difficult forceps delivery in 1941, after forty-eight hours of labor. It ended in the birth of a boy weighing 8 pounds and 3½ ounces (3,728 Gm.). This confinement resulted in a deep bilateral cervical laceration which caused low backache and vaginal discharge. Therefore in January 1945, the patient was operated on at the Nix Memorial Hospital in San Antonio, Texas, at which time a repair of the cervix (modified Sturmdorf), a suspension and an appendectomy were done. The operative report reads as follows:

"Patient was prepared in the usual manner, cervix found to have a long anterior and posterior lip, because of the bilateral laceration, with marked inflammatory changes of both lips. A modified Sturmdorf was done. Hemostasis was secured. All raw areas covered with

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From the Department of Obstetrics, Elizabeth General Hospital, Elizabeth, N. J.

normal mucous membrane tissue. Pack inserted for hemostasis.

"Patient's abdomen was then prepared in usual manner, peritoneal cavity entered, retrodisplaced uterus found. Uterosacral ligaments were shortened, cul-de-sac was closed, round ligaments on both sides brought to the anterior surface of the uterus by the Coffee method. Rest of the tissue was normal. Appendix was then removed and found to be chronically inflamed. Appendix was removed in the usual manner using no purse-string, phenol and alcohol to base. Abdomen closed in usual manner, continuous plain to peritoneum, continuous chromic to fascia, interrupted wire to fascia and skin clips."

She then had a five-month spontaneous abortion in October 1945, a six-week spontaneous abortion in July 1946, a six-week spontaneous abortion in June 1948 and another in December 1951 which also was at about six weeks. None of these abortions required dilation and curettage.

When first seen, the outlet had good support. There was a moderate vaginal discharge. The vaginal mucosa was normal except for several inclusion cysts in the anterior vaginal wall. The cervix showed bilateral deep lacerations, with eversion of both anterior and posterior lips, which appeared firm and stubby. Inspection of the cervix did not substantiate the report that any amputation (modified Sturmdorf?) had been performed. The uterus was anteflexed and of normal size and shape. Both adnexae were normal. Tests for basal metabolism, hysterosalpingographic study, an endometrial biopsy and a Huhner test all gave perfectly normal results. In the final report the patient was told that no explanations for her four previous miscarriages could be found except the bilateral laceration of the cervix, and it was suggested that she be admitted to this hospital for plastic repair of the cervical canal. On June 28, 1952, a dilation and curettage, followed by a trachelorrhaphy (Emmet's operation) was performed. The operative observations were as follows: "Moderate relaxation of the outlet is noted. There is a deep laceration on both sides of the cervix, reaching into the vaginal vault, with marked eversion of both lips. Many Nabothian cysts, as well as chronic endocervicitis, were noted. The uterus is of normal size and freely movable. The adnexae are not enlarged. Dilatation and curettage were performed and a large amount of velvety endometrium removed. A triangular piece of cervical mucous membrane was excised from the anterior and posterior lips on the right side, and the two raw surfaces were brought together with interrupted sutures of No. 1 chromic catgut. The sutures were left untied. The same procedure was repeated on the left side, after which all sutures were tied, and a new cervical canal was formed into which a 1-inch (2.3 cm.) iodoform gauze strip was inserted like a wick." The patient made an uneventful recovery and was discharged from the hospital after three days. She was seen again four weeks after the operation, and the cervix appeared well healed. She then was instructed to try to become pregnant in August 1952.

She had her last menstrual period on October 1. A Friedman test done on November 14 gave a positive result. The patient was given normal antepartum care. Her pregnancy progressed uneventfully and the membranes ruptured at 8 a.m. on July 5, 1953. She went into labor spontaneously at 2:30 p.m. on the same day. She had a short and unremarkable labor and was delivered of a normal boy weighing 7 pounds and 8 ounces (3,402 Gm.) at 8:37 p.m. After delivery the cervix was exposed and inspected, and it was observed that both suture lines on the lateral aspects of the cervix had torn open again. In addition there was a vaginal tear, so that the right labium minus was torn off from the vaginal mucous membrane. The cervical lacerations as well as the vaginal tear were repaired in the usual manner, with interrupted sutures of No. 00 chromic catgut.

This case seems to prove that a bilateral cervical laceration sustained at a previous difficult operative delivery may be a reason for future spontaneous abortions. In evaluating these cases, not enough attention is paid to the cervical factor, and in patients with habitual abortions, where no other pathologic change can be found that may be responsible for these continuous mishaps, repair of cervical lacerations by means of Emmet's trachelorrhaphy appears to be a worthwhile procedure.

## SUMMARY

A case of habitual abortion due to bilateral cervical lacerations suffered at a previous operative delivery is prese
After Emmet's trachelorrhaphy ha
performed, the w

and was spontaneously delivered of a living child.

### RÉSUMÉ

L'auteur présente un cas d'accouchement qui nécessita une opération et des incisions bilatérales du col et qui fut, par la suite, la cause d'un avortement. Après avoir subi l'opération d'Emmet, la malade devint à nouveau enceinte et accoucha spontanément d'un enfant vivant.

### RIASSUNTO

Viene descritto un caso di aborto abituale dovuto a lacerazioni bilaterali della cervice consecutive ad un precedente parto distocico. Dopo una trachelorrafia secondo Emmet la paziente portò a termine una gravidanza ed ebbe un parto normale.

### RESUMEN

Se comunica un caso de aborto habitual debido a laceraciones bilaterales del cervix sufridas en un parto operatorio previo. Después de la traquelorrafía de Emmet la mujer se embarazó tuvo un parto espontáneo con niño vivo.

### ZUSAMMENFASSUNG

Es wird ein Fall von habituellem Abort infolge von doppelseitigen Gebärmutterhalszerreissungen, die bei einer früheren operativen Entbindung entstanden waren, beschrieben. Nach Ausführung einer Emmetschen Trachelorrhaphie wurde die Frau schwanger, und es erfolgte spontane Entbindung eines lebenden Kindes.

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Young men wish: love, money and health. One day they'll say: health, money and love.

It is strange that thought should depend on the stomach, and still that men with the best stomachs are not always the best thinkers.

Before undergoing a surgical operation arrange your temporal affairs. You may live.

Ugliness is a point of view: an ulcer is wonderful to a pathologist.

# An Improvised Frame for Temporary Splinting in the Treatment of Congenital Dislocation of the Hip

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AFTER reduction of congenital dislocation of the hip, if the surgeon has elected to use plaster of paris *casts in the frogleg position,* several changes are necessary for reasons of hygiene and also because of the growth of the child. At times, however, when a change of cast is contemplated and one *is still in the stage of treatment* at which maintenance of the position of abduction and flexion of the thighs is important, one may find it impracticable to apply a new cast. The old cast is now odorous and soiled, and the skin underneath may be covered with macular and pustulous lesions; it is generally red and partly macerated from contact with the cast. The cutaneous lesions have to be treated for a number of days before a new cast can be applied, and at the same time one does *not want to change the frogleg position.*

In such a situation a frame that can be improvised in a few minutes has proved exceedingly useful. It could also be used when intercurrent disease makes it necessary to remove the cast, although such an occasion has not arisen in my own experience.

The frame is shaped by taking a length of Kramer wire ladder splint 17½ to 18 inches (44.3 to 45.7 cm.) long and 3½ inches (8.9 cm.) wide and bending it in such a manner that one long and the two short sides of a rectangle are formed. The long side corresponds to the distance between the right and left popliteal area with either thigh in the flexed and abducted position. The short side corresponds to the length of the posterior aspect of the right and left leg, respectively, from the popliteal fossa down to 1½ inches (3.7 cm.) above the ankle joint. The mid-

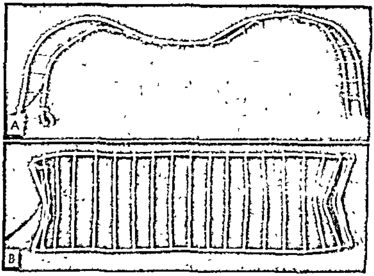

Fig. 1.—Frame shaped from Kramer wire splint.

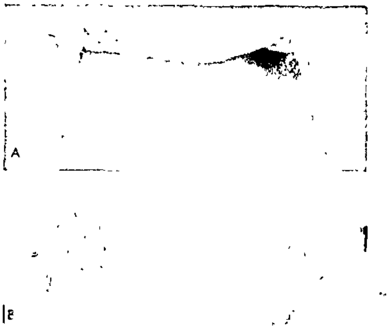

Fig. 2.—

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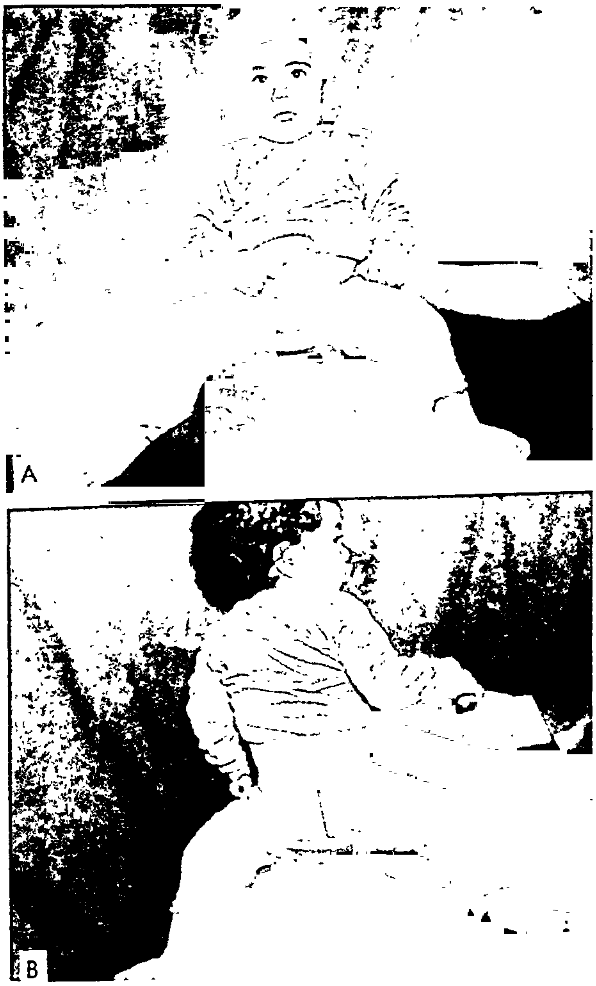

Fig. 3.—Lower extremities bound to frame with bias cut stockinette bandages. The skin of the pubic, perineal and gluteal areas can be easily cared for.

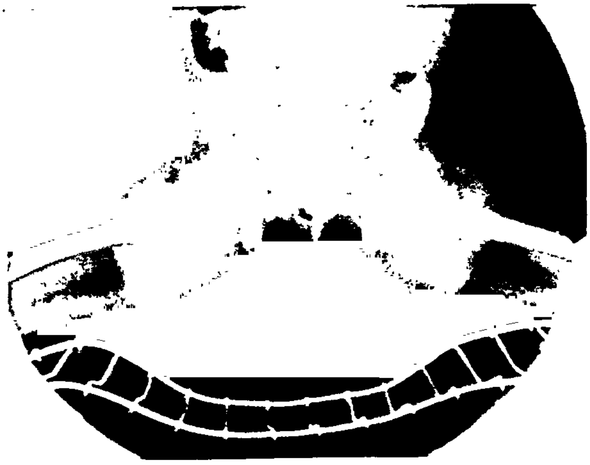

Fig. 4.—Roentgenogram taken with the frame in position.

portion of the long side is depressed toward the center of the frame and away from the pubic and perineal regions. The wire rungs are bent toward the center of the frame so that they are slightly concave at the side of contact with the extremities (Fig. 1, *A* and *B*). It is best to start with a longer piece of splint, because if the short sides are too long they can be easily trimmed with wire cutters. The length of the long side can be gauged by the distance between the areas of the cast that correspond to the popliteal regions. Several layers of sheet wadding are wrapped around the frame for padding, and the appliance is made moisture-proof by covering it with oiled silk (Fig. 2, *A* and *B*).

The frame is then placed between the abducted and flexed thighs. There is contact between the posterior surfaces of the thighs and legs from the ischial tuberosities down to 1½ inches (3.7 cm.) above the ankle. The thighs and legs are bound to the frame by bias cut stockinette bandages. The pubic and perineal regions clear the depressed portion of the top of the frame by 1 to 1½ inches (2.5 to 3.7 cm.), and one has no difficulty in keeping these parts clean by frequent changes of diaper. The abdomen, pubic, perineal, gluteal and low back areas are entirely free of any kind of covering, and the skin can be well cared for by exposure to air, the use of corn starch powder and whatever applications are indicated.

The child can be picked up and frequently turned from a supine to a prone position (Fig. 3, *A* and *B*). The lower extremities can be cleaned by removing the bandages from one leg at a time. An aide holds the leg in a flexed and abducted position, and with the frame pushed to the other side (which will increase the abduction of the opposite thigh), the skin is accessible everywhere. The frame allows for a few degrees of flexion extension movements in the hip joints, but abduction is always maintained (Fig. 4). As compared with a spreader bar, it has the advantage that no strain is put on the knee joints. It has the disadvantage that more care is required on the part of the mother or nurse.

### SUMMARY

A simple frame is described for temporary use in the treatment of congenital dislocation of the hip. It is cheap and quickly improvised and offers continued maintenance of the frogleg position when plaster of paris cannot be used on account of poor condition of the skin or an intercurrent disease. It is an expedient device, but in some cases, because of inadequate attention to sanitary requirements at home, it has been substituted for the plaster of paris cast.

### RESUMEN

Se describe un cuadro simple para uso temporal en el tratamiento de la dislocación congénita de la cadera. Es barato y facilmente improvisable y ofrece mantenimiento continuo de la posición en pierna de rana cuando no puede usarse enyesado a causa de la condición de la piel ó padecimientos asociados. Es una idea apropiada, pero en algunos casos a causa de la atención inadecuada de los requerimientos higiénicos hogareños ha sido substituído por los enyesados.

### ZUSAMMENFASSUNG

Es wird ein einfacher Rahmen zur vorübergehenden Verwendung in der Behandlung angeborener Hüftgelenksverrenkungen beschrieben. Der Rahmen ist billig, lässt sich schnell und ohne Vorbereitungen herstellen und ermöglicht die ständige Erhaltung der Froschschenkelstellung, wenn Gipsverbände wegen schlechter Beschaffenheit der Haut oder wegen interkurrenter Erkankungen nicht angewandt werden können. Der Apparat ist praktisch, musste aber in manchen Fällen wegen ungenügender Beachtung der sanitären Vorschriften im Hause des Kranken durch Gipsverbände ersetzt werden.

### RÉSUMÉ

L'auteur décrit une attelle pour le traitement de la luxation congénitale de la hanche. Elle revient à bon marché et peut être rapidement improvisée; elle maintient le sujet en position classique, dans les cas où on ne peut pas utiliser le plâtre de Jaris par suite du mauvais état de la peau ou de maladie les conditions d'hygiène n'étant pas satisfaisantes quand le malade est soigné à domicile, on a utilisé le plâtre de Paris.

### RIASSUNTO

Viene descritto un dispositivo semplice di uso temporaneo nella cura della lussazione congenita dell'anca. E' economico, facilmente procurabile e consente di mantenere le anche divaricate fino a che non si possa fare l'apparecchio gessato, per particolari ragioni.

E' un apparecchio di grande utilità in casi particolari.

Obstinacy and heat in argument are surest proofs of folly. Is there anything so stubborn, obstinate, disdainful, contemplative, grave, serious, as an ass?

—*Montaigne*

# Section on Ophthalmology and Otorhinolaryngology

PAUL C. CRAIG, M.D., F.A.C.S., F.I.C.S., EDITOR

# Acoustic Trauma: A Clinical and Laboratory Study

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IN the year 1883 there occurred in the Straits of Sunda between the island of Java and the island of Sumatra, a natural catastrophe which was probably the greatest in recorded history. The volcano Krakatau erupted. Thirty thousand persons were killed by the explosion, its gases, its fiery lava, its tidal wave and its earthquakes. As an unimportant by-product of this eruption there was created a tremendous noise. It has been said that the noise of the volcano in the Sunda Straits was heard thousands of miles away in Australia. This was the loudest sound produced in historical times.

Disasters like eruptions of volcanos are extremely rare and do not constitute any particular danger to the ear. Thunder, heavy storms and other noises of nature, like waterfalls and surf, are not severe enough, not of sufficient duration and not abrupt enough to be harmful to the ear.

Acoustic trauma, as the term is here used, is a by-product of modern industrial civilization and of total warfare. One can define acoustic trauma as an injury to the ear caused by sound. It has been known in a general way for the past hundred years that excessive noise is harmful to the ear. It is only during the past ten or fifteen years, however, that increased interest has been created and active preventive measures taken. To a certain extent the reasons for increased interest are medicolegal. Some state legislatures have enacted statutes that make industrial noise a compensable disability. It can be expected that many workmen will file claims for compensation. If this happens, or, rather, since it has already begun to happen, industry, insurance companies, labor and, last though not least, the otologist must take an increased interest in acoustic trauma.

The problem of industrial noise and the acoustic problems of modern warfare are only in their initial phase. This is the age of jet engines. A few observations have been made that demonstrate the harmful effect of jet engines. More powerful jet machinery will be put in commission, and therefore increased otologic problems will be created. The noise levels of jet engines are enormous. The sound pressures may become so high that all tissues of the body execute mechanical vibrations of large amplitude. It is not known at this time what nonauditory problems, perhaps pertaining to the vestibularis or to the brain matter in general, will become important when more jets come into use.

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It is obvious, therefore, that the otologist must be thoroughly interested in and fully informed about the many physical, physiologic, audiologic, pathologic and medicolegal aspects of acoustic trauma.

Two main types of damage to the ear can be distinguished (1) the effect of air blasts, e. g., detonations, gunfire and bomb explosions, and (2) the effect of sustained stimulation of high intensity—industrial noise as heard in machine shops, steel mills, weaving mills, forges and the like.

Parallel to but not identical with these two causes of ear damage are two types of damage in the ear: (a) a physical destruction of the sound conduction system, caused by traumatic bursting of the eardrum or round window membrane with fractures of the ossicles and hemorrhages, and (b) slow degeneration of the neurosensory structures in the inner ear. Hair cells, nerve fibers, and ganglion cells in the cochlear ganglion may be affected and may degenerate; like old soldiers, they just fade away.

The first step in effective abatement of industrial noise is the recognition of its importance. The second step is the planning of effective teamwork between management, industrial engineers, tool designers, safety directors, acoustic consultants and otologists. Certain machinery can be designed so as to make less noise in operation; other types can be shielded, and some performances can be executed without an operator present or near by. Many individual solutions can be found if there is only the will to find them.

Workers can wear a plug in the ear, which offers a certain although limited protection. The best ear plugs attenuate sound by 30 to 35 decibels. But it should be kept in mind that even the best plug does not function properly if it is not placed correctly in the ear canal.

It is important to ascertain the hearing ability of the worker before he begins his work. If he becomes deaf after working in a noisy place, the comparison of his hearing with the pre-employment examination will provide a yardstick to measure the hearing impairment caused by the industrial noise. Too many workers still are employed without a pre-employment audiogram. The result is that any later claim cannot be clearly interpreted.

More information is necessary to assess the natural aging of the human ear. Suppose a 60-year-old worker, after twenty-five years of service in a drop forge, files a claim on account of hearing impairment. His interpretation is that his hearing is diminished because of his work in the shop for twenty-five years. In reality at least two factors, if not more, cause the hearing impairment. Granted, the high noise level has damaged his ear, but in addition he has become twenty-five years older in the meantime. It is common knowledge that the hearing diminishes with advancing age. It is not possible by existing clinical and audiological methods to distinguish which percentage of the hearing impairment is caused by age, which acquired by disease or hereditary factors and which by noise.

Otologic science is simply not advanced enough to provide the answers to these important questions. Since it is the aim of the profession that just and equitable decisions be made by the industrial commission, otologic science must take steps to study these problems by intensive laboratory investigation. One does not wish to see a worker denied a justified claim because the otologist failed in diagnosis, nor does one like to see an insurance company pay compensation for a hereditary deafness that happens to be indistinguishable from acoustic trauma.

Thorough knowledge of the morphologic and physiologic aspects of the ear is a prerequisite to the study of acoustic trauma. Acoustic overloading is a physical problem. It deals with maximum stimulation and maximal responses of the human ear. A knowledge of the construction materials of the human ear, and of its tolerance, is important.

Unfortunately the ear is small; its structures are hidden deep in the skull, and, last but not least, acoustic phenomena take place very rapidly. It is possible, nevertheless, to overcome the technical difficulties and to record optically what happens in the ear. The motion picture camera has proved to be an excellent scientific tool for recording the physiologic acoustic phenomena in the ear during acoustic trauma. Laboratory tests have been carried out in which the elastic forces and the breaking point were tested. In addition, the ears of experimental animals were exposed to detonations. With the high speed motion picture camera (4,000 frames per second) cinematographic recordings were made of the ear during blasts. The sharp abruptness of the airblast and the excessive oscillations of the ear could be observed and measured. On certain occasions one could observe perforation of the eardrum and fracture of the ossicles. Other detonations, which were smaller or occurred at a greater distance, did not destroy the sound conduction system.

Sustained loud noises like those occurring in industry hardly ever destroy the sound conduction system physically. Large vibrations are carried out by the ossicles, but in most cases there is no visible physical damage seen in the middle ear. (Film demonstration of sound conduction system during maximum stimulation by sustained noise.)

The damage in the inner ear is only microscopic. Certain cell groups, e. g., the hair cells, degenerate; the nerve fibers and ganglion cells are affected in more severe cases, and finally the whole organ of Corti is destroyed.

The ear possesses a series of protective devices against excessive sound, the most important of which is the acoustic reflex of the middle ear muscles. These muscles contract on acoustic stimulation.

No effective treatment is possible once acoustic trauma has taken place and the nerve structures of the inner ear have been destroyed. All-important, therefore, is the *prevention* of acoustic trauma in the cochlea.

A practical solution for industry is well within the realm of possibilities. The otologist who acquires a knowledge of acoustic trauma and an interest in its prevention will be a better leader in his community, because he can furnish information and advice with regard to noise problems and noise protection.

## SUMMARY

Acoustic trauma is a man-made problem. Nature has no sound sources that damage the ear. But industrial and military conditions expose the human ear to sound intensities for which it is not made, for which it is not prepared and against which it is not protected.

More members of the armed forces are being exposed to explosions and gunfire and to loud sustained noises by airplane motors, jet engines, diesel engines and other noise-producing equipment. In industry, potential dangers to hearing arise from sustained excessive noises of machinery. The noises of the "jet age" pose a problem that is not yet clearly understood. Immediate laboratory and clinical observation are needed.

Through the use of a high speed motion picture camera, recordings have been made of the ears of experimental animals exposed to detonations. Rupture of the eardrum and fracture of the tiny bones inside were observed.

The ear possesses a series of protective devices against excessive sound. The most important protection is the acoustic reflex of the middle ear muscles, which contract on acoustic stimulation. No effective treatment is possible once acoustic trauma has taken place and the nerve structures of the inner ear have been destroyed. It is therefore all-important to prevent acoustic trauma in the cochlea. A practical solution for industry is well within the realm of possibilities. Construction of less noisy machinery will help overcome this serious industrial hazard.

## ZUSAMMENFASSUNG

Schallverletzungen sind vom Menschen

geschaffene Probleme. Die Natur kennt Schallquellen, die das Ohr verletzen. Die Verhältnisse in der Industrie und im Heereswesen jedoch setzen das menschliche Ohr Schallstärken aus, für deren Aufnahme es nicht geschaffen ist, auf die es nicht vorbereitet ist, und vor denen es nicht geschützt ist.

Eine ständig wachsende Zahl von Angehörigen der Wehrmacht ist Explosionen, Gewehrschüssen und den Geräuschen von Flugzeugmotoren, Jetmaschinen, Dieselmotoren und anderen lärmerzeugenden Apparaten ausgesetzt. In der Industrie ist das Ohr den Gefahren, die in den übermässigen Geräuschen der Maschinen liegen, ausgesetzt. Der Lärm des "Jet-Zeitalters" ist ein Problem, das noch nicht volles Verständnis gefunden hat. Unverzügliche Laboratoriumsuntersuchungen und klinische Studien sind notwendig.

Mit Hilfe von Filmkameras mit grosser Geschwindigkeit sind Aufnahmen vom Ohr von Versuchstieren, die Explosionen ausgesetzt wurden, gemacht worden. Zerreissungen des Trommelfells und Brüche der Gehörknöchelchen wurden beobachtet.

Das Ohr besitzt eine Reihe von Schutzvorrichtungen gegen übermässige Geräusche. Der wichtigste Schutz besteht im Akustikusreflex der Muskeln des Mittelohres, die sich auf akustischen Reiz zusammenziehen. Hat eine Verletzung des Akustikus einmal stattgefunden, und sind die Nervengebilde des inneren Ohres einmal zerstört, gibt es keine wirksame Behandlung mehr. Daher ist es von überragender Wichtigkeit, akustische Verletzungen in der Schnecke zu verhüten. In der Industrie liegen praktische Lösungen des Problems durchaus im Bereiche der Möglichkeiten. Die Konstruktion weniger geräuschvoller Maschinen kann dazu beitragen dieses schwere industrielle Risiko zu vermeiden.

## RESUMEN

El trauma acústico es un problema producido por el hombre. La naturaleza no tiene fuentes de sonido que lesionen al oído. Contrariamente, las condiciones industriales y militares exponen al oído humano a intensidades de sonido para las cuales dicho órgano no ha sido hecho, para las cuales no esta preparado y contra las cuales no esta protegido.

La mayoría de los miembros de las fuerzas armadas han sido sometidos a explosiones de armas de fuego y sonidos sostenidos bajos, tales como los producidos por motores de aeroplanos, de propulsión a chorro, diesel y otras maquinas productoras de sonido. En la industria los poligros potenciales para la audición se producen por ruidos excesivos y sostenidos. Los ruidos de la "edad de la propulsión a chorro" plantean un problema que no es entendido claramente, requiriéndose observaciones de laboratorio y clínicas inmediatas.

A traves del uso de camaras cinematográficas de alta rapidez cinética, se han obtenido registros de los oidos de animales experimentales expuestos a detonaciones. Se observaron rupturas del tímpano y fractura de los huesos del oído medio.

El oído posee una serie de mecanismos protectores contra el sonido excesivo. La protección más importante es el reflejo acústico de los músculos del oído medio que se contraen bajo la estimulación acústica. No existe un tratamiento efectivo posible una vez que se ha producido el trauma acústico y que se han destrùido las estructuras nerviosas del oído interno. Es por lo tanto importante, el prevenir el trauma acústico en la coclea. En la industria está a alcance posible una solución prática. La construcción de maquinas menos ruidosas, ayudaría a contrarestar los graves peligros de la industria.

## SUMÁRIO

O trauma acústico constitute problema produzido pelo homem. A natureza não possue fontes de som que lesem o ouvido. Mas as condições industriais e militares expõem o ouvido humano à intensidades de som, para as quais não está adaptado, preparado: e, contra as quais não está protegido.

Maior número de membros das forçadas

estão sendo expostos a explosões, tiros e ruídos fortes produzidos por motores de aereoplanos, máquinas a jato, máquinas diesel e outros maquinários. Na indústria, os perigos potenciais da audição se originam pelos ruídos excessivos do maquinário. Os ruídos da "idade do jato" oferecem um problema que ainda não foi claramente compreendido. As observações clínica e de laboratório, imediatas, são necessárias.

Pelo uso de uma câmara cinematográfica de alta velocidade, têm sido feito registros dos ouvidos de animais experimentalmente expostos a detonações. Ruptura do tímpano e fratura de pequenos ossículos no seu interior foram observados.

O ouvido possue uma série de artifícios protetores contra o som em excesso. A proteção mais importante é o reflexo acústico dos músculos do ouvido médio, que se contraem sob estímulo acústico. Nenhum tratamento eficaz é possível uma vez que tenha ocorrido trauma acústico e as estruturas nervosas do ouvido interno tenham sido destruidas. Portanto, é muito importante impedir o trauma acústico na cóclea. Uma solução prática para a indústria está incluida no âmbito das possibilidades. A construção de maquinário mais silencioso auxiliará a vencer êste sério risco industrial.

### RIASSUNTO

Il trauma acustico è un problema creato dall'uomo, dacchè in natura non esistono rumori che possano offendere l'udito. L'orecchio non è fatto per la intensità dei rumori prodotti dalle industrie o dalla guerra. I soldati sono esposti alle esplosioni, agl scoppi delle armi da fuoco, ai rumori dei motori di aereoplano, dei reattori, dei motori diesel e degli altri meccanismi rumorosi. Gli operai dell'industria possono avere danni all'udito per i rumori delle macchine. Il chiasso dell' "età del reattore" crea un problema nuovo, non ancora affrontato e che merita uno studio immediato. Sono state studiate le orecchie di animali da esperimento esposti a detonazioni, usando una macchina da ripresa ad alta velocità. Si osservarono rotture della membrana e delle ossicine. L'orecchio possiede una serie di dispositivi di protezione contro i rumori eccessivi, fra cui, il più importante, il riflesso acustico dei muscoli dell'orecchio medio che si contraggono ad ogni stimolo. Non è più possibile alcuna cura dal momento in cui si è stabilito il trauma acustico e sono state distrutte le strutture nervose dell'orecchio interno.

* * *

Genius is a cruel disease. Every writer carries a canker in his heart, a devouring monster, like the tapeworm in the stomach, which destroys all feeling as it arises in him. Which is the stronger? The man or the disease? One had need to be a great man, truly, to keep the balance between genius and character. The talent grows, the heart withers. Unless a man is a giant, unless he has the thews of Hercules, he must be content either to lose his gift or to live without a heart.

—*Balzac*

# Editorial

## The Use of the Cobalt 60 Unit

SINCE 1925, when Coolidge first produced a sealed off tube operating at 300 Kv., there has been an accelerating interest in the therapeutic use of higher voltage roentgen apparatus. By 1933, a few very high voltage roentgen machines were available — Lauristsen's multi-section tube at Pasadena, which operated at 1,000 Kv., and a Coolidge cascade type tube of 700 Kv. at the New York Memorial Hospital. These machines, however, were mechanically not reliable enough for sustained clinical trial. Since 1936, supervoltage roentgen tubes have been produced in great variety, but it is only in the last few years that they have come into anything approaching routine clinical use. Roentgen rays of the order of 1,000,000 to 2,000,000 volts can now be considered to have passed the experimental stage, and undoubtedly supervoltage machines of this range will be widely distributed in the near future.

The careful and conservative prolonged clinical trials of Phillips[1] in London and Cantril and Buschke[2] in Seattle have done much to bring this situation about. A number of roentgen machines operating at energies of 1,000,000 to 2,000,000 volts are now scattered over the North American Continent and Europe. These machines are in more or less routine clinical use, and there is little doubt that they are proving superior to conventional roentgen machines in certain types of cases. Still in the experimental stage are linear accelerators and betatrons with energies ranging from 10,000,000 to 70,000,000 volts.

A more recent development has been the production of useful treatment units containing very large quantities of cobalt 60. These units can be considered roentgen machines of approximately 3,000,000 volts, since the gamma rays produced have similar properties.

Many of the older radiotherapists have considered the gamma rays of radium superior to conventional roentgen rays in the treatment of cancer. This impression has probably been fostered by the fact that radium in the form of radium implantation is much more suitable in the treatment of cancer in certain situations than is roentgen therapy. For instance, in the mouth, it is possible by a suitable implant to deliver a very high dose to a small volume and thereby to confine the effect of radiation to a small portion of the mouth. It is not possible to achieve this effect by external irradiation, and treatment with radium is therefore more likely to be successful. Furthermore, the comparison of radium treatment and roentgen treatment is difficult, since the dosage is different in each case. Radium is usually applied continuously over a period of days or for a large number of hours each day for several days, whereas roentgen treatment is usually employed in the form of brief daily exposures. There are really very few grounds for the belief that gamma rays of radium have a different biological effect as compared with roentgen rays, and this has been demonstrated effectively by Wood.[3] It is generally agreed that the biological effect of all radiations is produced by ionization in the tissues, and each ion is the same, whatever type of radiation produces it. There is some difference,

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[1] Phillips, R.: Super-voltage Therapy. H. K. Lewis & Co., 1947.

[2] Buschke, and Cantril: Super-voltage Roentgen Therapy. Springfield, Ill.: Charles C Thomas, Publisher.

[3] Wood, C.: Council H.M

however, in the spatial relation of the ionization produced by gamma rays as compared with conventional roentgen rays. For instance, in the path of a single photon produced at 200 Kv. through tissues, the average number of ions produced per micron is 55, as compared with 8.3 for 3 m.e.v. radiation, and 6.7 for 23,000,000 volts.[4] It is just possible that this change in mean linear ion density may produce different biological effects, since the lower the mean linear ion density the more evenly distributed throughout the different parts of each cell will be the ionization. It is therefore possible that there is more chance of a true differential effect between normal and malignant cells.

The radiations produced at energies of 1,000,000 to 4,000,000 volts, or with Cobalt 60, are similar physically to the gamma rays of radium. The mean linear ion density is about the same. Their great advantage over radium is that they can be directed at a patient from a greater distance because a very high output can be obtained, and therefore the inverse square law can, to a large extent, be overcome, permitting much higher percentage depth doses.

In August 1951, a 1,000-curie Cobalt 60 source was obtained by the Saskatchewan Cancer Commission from the Canadian Atomic Energy Project at Chalk River and installed in a locally designed and built unit at the University Hospital, Saskatoon. The machine has been in continuous clinical use since November 1951. The unit consists essentially of a lead-filled steel sphere, inside which is mounted a wheel that can be rotated 180 degrees by an electric motor. Set into the periphery of the wheel is the radioactive cobalt source, consisting of twenty-five discs, each 2.5 cm. in diameter and 0.5 mm. thick, and arranged in the form of a cylinder 1.2 cm. high. When the wheel is rotated to the "on" position the cobalt can "see" the exterior through a hole in the lead sphere. By means of a collimating apparatus and cones, beams of various sizes can be obtained. When the wheel is rotated 180 degrees the cobalt is shielded by a tungsten alloy plug in the wheel, and no significant radiation escapes. Various accessory equipment can be mounted on the head[5] for accurate beam direction. The whole apparatus, weighing about a ton, is suspended from overhead rails by a central column. It can be moved backward and forward, up and down, and rotated by electric motors controlled by a box of push-buttons held in one hand. Under the machine there is a circular section of the floor that can be made to rotate at varying speeds by an electric motor. The control panel is very simple; it consists merely of an electric timing clock which rotates the wheel to the "on" position and automatically rotates it "off" when the desired exposure is given. A series of interlocks prevents the machine from operating when the door to the treatment room is open. Further details of construction may be found elsewhere.[6] Since the moving parts are few and simple, no costly repairs or replacements are required. The Cobalt 60 has a "half-life" of a little over five years, and hence has to be replaced when the output becomes too low for practical use.

With conventional roentgen rays, when a large volume is irradiated, there is always a hazard of radiation sickness and leukopenia. This effect is due to absorption by the body as a whole of a large amount of radiation. When a similar volume is treated with supervoltage irradiation, however, to the same dose, the absorption of radiation of the body as a whole is considerably reduced—in some instances to only a third or a half.[4] This difference is achieved because supervoltage radiation tends to be confined to the geometric beam and very little side-scatter occurs. With the use of similar technics in treating large volumes of tissue, radiation sickness will be less likely to occur with supervoltage therapy.

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[4] Watson, T. A.; Johns, H. E., and Burkell, C. C.: The Saskatchewan 1000 Curie Cobalt 60 Unit. Am. J. Roentgenol. & Rad. Therapy, to be published.

[5] Watson, T. A.: The Clinical Possibilities of the Cobalt 60 Beam Unit, J. Canad. A. Radiologists 3:7, 1952.

[6] (a) Johns, H. E.; Bates, L. M., and Watson, T. A.: The Saskatchewan Cobalt 60 Unit, Brit. J. Radiol. 25:296, 1952.

6. (b) Burkell, C. C.; Watson, T. A.; Johns, H. E., and Horsley, R.: Skin Effects of Cobalt 60 Telecurie Therapy, Brit. J. Radiol., to be published.

An important advantage of supervoltage irradiation is the great penetrating power of the rays. The percentage dose reaching a deep tumor is very much higher than with conventional roentgen rays.[7]

In general, with conventional roentgen irradiation, the dose is at a maximum where it strikes the surface of the body, and thereafter falls slowly. With the supervoltage machine, however, the dose does not reach a maximum till it penetrates some distance below the surface of the skin. This distance depends on the energy of the radiation. For instance—with roentgen rays of 2,000,000 volts it is about 3 or 4 mm., while with cobalt irradiation,[8] it is 5 mm.; and with even higher energy machines, such as the 23,000,000 electron volt betatron, the 100 per cent level is not reached before penetration to a depth of 4 cm. It is, therefore, obvious that cutaneous reactions for similar incident doses will be very much less with supervoltage roentgen rays than with the usual kind. My co-workers and I have shown[6b] that, if one interposes unit density material of varying thicknesses between the applicator end and the skin, this physical factor is of very great importance in the production of milk skin effects. A further factor lessening the skin effect of these rays is that elements in the skin, such as sulphur, do not contribute nearly as much secondary radiation as with low voltage roentgen rays. The skin-sparing effect is of considerable importance in routine clinical use, but it must be remembered that when a deep tumor is being treated by irradiation of any kind, it is the dose actually received by the tumor and its immediate vicinity that is important. The effect on the skin gives no indication whatsoever of the dose received by the tumor.

A further physical consideration that is valuable in therapy is that high voltage rays are absorbed more nearly equally by bone, cartilage, and soft tissues than are low voltage roentgen rays.[4] With the latter, bone will absorb several times as much energy as will the surrounding soft tissue, and therefore necrosis of bone or cartilage is more likely to develop at the lower energy levels. Examples of this are cartilage necrosis in the treatment of cancer of the larynx, bone necrosis in the treatment of tumors about the jaw, or fractures of the neck of the femur in the post-radium roentgen treatment of cancer of the uterine cervix.

The indications for the use of high voltage therapy follow logically from these various physical advantages. It is obvious that the high percentage depth dose and the comparatively low integral dose are particularly applicable to the treatment of deep-seated tumors. By the use of a few cross-firing beams very high tumor doses can be obtained, with simultaneously low skin doses. The cutaneous reaction is further reduced by the lesser skin effect of the incident high energy roentgen rays.

These advantages may be further enhanced by the employment of rotational technics,[9] by which the roentgen beam is continuously directed at the tumor while the patient is rotated. The beam, therefore, while always striking the tumor, enters the body through a constantly changing skin surface. By offsetting the center of rotation, volumes of tissue of various shapes and sizes (e.g., the chest wall and the axilla in cases of inoperable carcinoma of the breast) can be irradiated homogeneously without undue exposure of surrounding normal structures—the so-called "scanning" technic.[10]

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[7] (a) Johns, H. E.; Darby, E. K.; Watson, T. A., and Burkell, C. C.: Comparison of Dosage Distributions with 400 K.V.P. x-rays and 22 m.e.v. x-rays, Brit. J. Radiol. 22:290, 1950.

[7] (b) Johns, H. E.: Physical Characteristics of the Radiation in Cobalt 60 Beam Therapy, J. Canad. A. Radiol. 3:2, 1952. Watson et al.[4] Johns et al.[6a]

[8] Watson et al.[4] Johns.[7b]

[9] (a) Stapleton, J. E.: Treatment of Advanced Carcinoma of the Bladder with Two Million-volt Rota[illegible] 4:207, 1953. (b) [illegible]age, E. W.; King[illegible]. J.; Jones, I. B., and Smithers, D. W.: The Two Million Volt Van DeGraff Generator Installation Designed for Rotation Therapy at the Royal Cancer Hospital, Brit. J. Radiol. 26:57, 1953.

Carcinoma of the esophagus, because of its deep situation, is better treated by high-energy roentgen rays than by conventional ones, as is inoperable carcinoma of the lung, in which useful palliation can sometimes be obtained. Large infiltrating tumors of the bladder[11] can be resolved with reasonable frequency. Good palliative results have been reported in the treatment of inoperable carcinoma of the rectum.[1]

Secondary deposits in bone are probably better treated by supervoltage roentgen rays, because the differential absorption of bone is less than with rays of lower voltage. Although conventional roentgen rays are absorbed more by bone than by soft tissues, this extra dose in confined to the hard bone only, and the increased secondary electrons do not penetrate more than a few microns into the bone spaces.[12a]

Carcinoma of the larynx or pharynx should respond better to supervoltage therapy, since the hazard of cartilage necrosis is less.

Although cutaneous reactions, for the physical reasons previously mentioned, are much less severe, my experience has shown that, for the same tumor dose, mucosal and tissue reactions are practically the same as those produced by 400 Kv. roentgen rays. This treatment cannot be undertaken lightly. When there is a possibility of eradicating a tumor the treatment, like the operation, must often be "radical." By this I mean that considerable physical calculation involving the construction of isodose distributions for each patient must frequently be made. Every effort, often involving the construction of individual plaster casts, must also be made to direct each field accurately, so that the volume of irradiated tissue is reduced to a minimum, and deep tumors must be localized to obtain optimal results. The continuous collaboration of radiation physicists is essential.

It should be emphasized that no new principles are involved in the use of the Cobalt 60 unit. The great publicity accorded it in popular magazines and newspaper articles is to be deplored, and arises from a misapprehension of the factors involved. It has been pointed out that the rays produced are very similar to those produced by 1-3 m.e.v. roentgen ray machines, which have been in use for some years, and one cannot say, therefore, that a new "cure" for cancer has been found. The most that can be claimed is that some radiotherapeutic technics can be extended and made more effective by the use of these high energy roentgen rays.

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[10] Trump, J. G., and Webster, E. W.: Rotational Scanning of Breast Malignancies with Super-voltage Radiation. Am. J. Roentgenol., Rad. Therapy and Nucl. Med. 68:35, 1953.

[11] (a) Watson, T. A., and Burkell, C. C.: The Betatron in Cancer Therapy, J. Canad. A. Radiol. 2:60, 1951; ibid. 3:25, 1952.

11 (b) Stapleton.[9a] Wheatley and others.[9b]

[12] (a) Spiers, F.: The Influence of Energy Absorption and Electron Range on Dosage in Irradiated Bone, Brit. J. Radiol. 22:521, 1949. (b) Johns, H. E.; Epp, E. R.; Cormack, D. V., and Fedoruk, S. O.: Depth Dose Data and Diaphragm Design for the Saskatchewan 1000 Curie Cobalt Unit, Brit. J. Radiol. 25:302, 1952.

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The highest form of vanity is love of fame. It is a passion easy to deride but hard to understand, and in men who live at all by imagination almost impossible to eradicate.

—*Santayana*

# New Books

**Studies on Renal Colic and Its Treatment by Posterior Splanchnic Block.** By Lars Risholm. Acta Chirurgica Scandinavica; Supplement 184, 1954. 12 illustrations, complete Bibliography. 64 pages.

This treatise on renal colic deals first with a survey of the literature on the mechanism of this disease, after which the author describes his own experimental work on the production of renal colic in human subjects. The condition was produced through obstruction of the ureter by means of a bag catheter and observation and recording of the intravesical pressure and the sensation of pain at various ureteral levels.

He concludes that local increase in intraureteral pressure with distension of the wall does not always produce pain, but that increased pressure in the renal pelvis is the essential cause of renal colic. Hypoperistalsis of the ureter is present; thus, peristalsis of the ureter is present; thus, peristalsis of the ureter is not significant in the production of renal colic.

The technic of posterior splanchnic block is adequately described, and its advantages over paravertebral block are enumerated: it is easier to perform, it is less unpleasant for the patient, and only one injection is needed. No toxic effects are noted, and in some cases the response is used in the differential diagnosis of pain in other abdominal viscera.

The author used this treatment in 51 cases. All of the patients were quickly relieved of pain. In 13 the pain did not recur. In 5 the colic returned in twenty-four hours. In 33 pain recurred in two or three hours. Splanchnic block was repeated once or twice in 11 of these. No complications from the procedure were reported. It had no influence on the urinary flow, or on ureteral peristalsis to facilitate the passage of the calculus.

**Peptic Ulcer.** By C. F. W. Illingworth. Edinburgh and London: E. & S. Livingstone, Ltd., 1953. Pp. 287.

This book presents an extensive study of the peptic ulcer and of the ulcer problem generally. The author discusses extensively the physiologic nature of gastric secretion and gives a brief review of the blood supply. A brief statistical review leads to the chapters on etiology, clinical symptoms, treatment and complications.

The author is fair in discussing viewpoints with which he does not agree. He rejects simple vagotomy and favors vagotomy and gastroenteroanastomosis or resection. The book is up to date on the research of the last few years, although, in the chapter on perforation, the author should have discussed the danger of perforation in cortisone treatment. Each chapter is followed by a brief bibliographic index. All in all, the book is a comprehensive and worth while addition to the literature on peptic ulcer and should be of great interest to the internist and the surgeon.

WERNER F. EISENSTAEDT, M.D.

**Mastopathie und Milchdrüsenkrebs . . . zugleich zweite umgearbeitete und ergänzte Auflage von Pathologie, Klinik und Behandlung der Mastopathie.** By George E. Konjetzny. Stuttgart: Ferdinand Enke, Verlag, 1954. Pp. 140. Illustrated.

When Konjetzny, one of the leading figures of the contemporary surgical world, decided to issue a review and evaluation of the whole problem of mastopathic conditions in the female, after twenty-five years' experience with this important question, it was an event of first importance.

The first edition of Konjetzny's *Mastopathie* appeared in 1942. Neither its modest form of publication nor the author's personal modesty concealed in the least the significance of the book, which was devoured and redevoured by those of his admirers who had access to it. This edition has been out of print for some time.

The second and revised edition takes on extra importance for several reasons. For one, it is possible that the original contribution, appearing at a time of world stress, could most easily escape the attention of surgeons living outside Germany and
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Largely this is a faithful
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The changes and additions are most significantly mirrored in the altered title, with its primary emphasis on the mastopathy-cancer relation. This was stressed as an essential topic of the earlier edition. Ten additional years have led the author to the conclusion that it is the central problem.

It has also been possible to reorganize the contents in somewhat more logical order, and thus make room for additional theoretical material at the beginning. The result is a more rounded treatise, with separate sections on pathology, histology, and etiology—a treatise that can now serve as a useful handbook for the practicing physician. The discussions on anamnesis, diagnosis and clinical material have also been combined into one clinical section. Place is also made for additional and more recent clinical evidence and citations from more recent contributors.

General surgeons who can take advantage of the German will recognize here one of the most mature and compact evaluations yet seen concerning a problem that faces us daily.

The scope of the book can be judged from its contents by chapter: I. Introduction. II. History of Mastopathy. III. Pathological Anatomy. IV. Histology of Mastopathy. V. Etiology of Mastopathy. VI. Clinical Material: Frequency of Mastopathy, Mastopathy in which Woman? Age, Race, Previous History, Pain, Pathological Secretion, Palpation, Diagnostic Operation. VII. Mastopathy and Carcinoma: Frequency, Special Cases, Association of Mammary Carcinoma and Mastopathy. VIII. Treatment of Mastopathy: Hormonal, Undesirable Side-effects of Hormone Treatment, Roentgen, Spontaneous Recovery and Recovery Following Gynecological Operation, Surgical, Summary of Surgical Treatment. Bibliography.

In his final pages, Konjetzny adds emphasis to his earlier statement on the limitations and the highly individual conditions for successful surgical treatment. Operation should not be unnecessarily extensive, and radical operation should be based on compelling grounds only. The situation is one, however, in which the treatment is not easily standardized but depends essentially on the individual case. At present, the author points out, there is no simple scheme of indications adequate to the great variation that mastopathic conditions actually present. Faced with a choice of procedures, the surgeon in this field must therefore be much more than an expert technician. He must also become an expert in diagnostics, symptomatalogy and pathology, if he is to find his way to the correct treatment.

MAX THOREK, M.D.

**Intratracheal Intubation in Anesthesia.** By Henri Gilbert. Paris: G. Doin et Cie., 1953. Pp. 199, with 39 illustrations.

This monograph describes clearly the anatomic structure of the respiratory tract, including the oral and nasal cavities, the larynx and the trachea, knowledge of which is of importance in endotracheal intubation. In addition, it covers the most common abnormalities and pathological changes which may create difficulties in or even make it impossible to perform intubation. Dr. Gilbert stresses the value of indirect laryngoscopic study in the preoperative examination of the patient so that the intubation may be safe, atraumatic and rapid. When nasal intubation is contemplated, examination of the nasal cavities and epipharynx is essential.

A complete step-by-step description of the technic of direct and "blind" nasal intubation is presented, with emphasis on the dangers, difficulties and possible false routes, as well as the complications that may occur during and after the procedure. Separate chapters deal with the route for intubation (oral or nasal), the problem of aspiration, the technic of extubation and, briefly, the management of anesthesia in the intubated patient with various agents. The author indicates the absolute and relative indications for intubation, which depend on the presence of an emergency situation, the type of surgical operation proposed and the requirements during anesthesia to insure safety for the patient and adequate working conditions for the surgeon. A brief review of the problems of respiration, together with a list of contraindications to intubation, concludes the work.

This book is a valuable addition to the literature on intubation. An improvement would have been the use of colored rather than black-and-white drawings.

H. CHIARI, M.D.

**1954 Medical Progress: A Review of Medical Advances During 1953.** Edited by Morris Fishbein. New York: The Blakiston Co., 1954. Pp. 345.

With the appearance of the second volume of this new series, one is gratified to note that one's original evaluation seems fully justified. The concept which holds that a book-length survey is useful and welcome to practitioners and allied medical scientists is a sound one. The editors have again done a first-rate job of weeding out the important developments of the year, and presenting the facts with precision and conciseness.

Apparently the previous volume was criticized in some quarters for repetitions in different chapters. While this reviewer did not consider these serious, it is gratifying to note an effort by the editors to correct this defect. At the same time we agree with them that a certain amount of repetition is necessary if the reader is to benefit from the points of view of the various contributing specialists.

New chapters are those on endicrinology, ophthalmology, gynecology, rehabilitation, medical psychology, and physical medicine. Chapters on hypertension, obstetrics, and thoracic diseases were omitted this year.

The review of the surgical field has come under the editorial scrutiny of Charles Mayo and Lowell Smith. Introductory comments on limitations to radical operation are followed by a review of supportive therapy, with emphasis on the complications due to cortisone. Then comes a systematic regional survey and a useful bibliography of 135 items from the literature. Important surgical material is also found, of course, in the chapters on Orthopedic Surgery (Frank Ober) and Gynecology (Ralph Reis). Unfortunately, there seems to be inadequate treatment of the important work in neurosurgery and neurology, and this should be corrected in forthcoming editions.

PHILIP THOREK, M.D.

**Surgical Infections.** By Edwin J. Pulaski. Springfield, Ill.: Charles C Thomas, Publisher, 1954. Pp. 315, with 10 illustrations.

This is Publication 170 in the American Lecture Series. The book was originated as a small manual on the use of antibiotics in the treatment of surgical infections. One must realize, however, that there is a tendency to rely on these drugs rather than use the sound surgical principles taught in presulfa days. This book is dedicated to the use of antibiotics *properly,* in combination with worthwhile indicated surgical measures.

The monograph is divided into two parts. Part 1 deals with antibiotic therapy, including history, dosage, complications, combinations, failures and the special groups. Part 2 deals with the management of surgical infections. General principles are stated at the outset. Specific infections are detailed, and specific wound infections are discussed thoroughly. The larger portion of Part 2 is devoted to regional infections, from neck, trunk, extremities, and hands, to the physiologically integrated systems involved—i.e., the central nervous system, the lungs, pulmonary, peritoneal, gastro intestinal, etc.

Every doctor, regardless of his field, should be fascinated by such a well organized, readable and readily absorbable text.

JEROME J. MOSES, M.D

**An Atlas of Congenital Anomalies of the Heart and Great Vessels.** By Jesse E. Edwards, Thomas J. Dry, Robert L. Parker, Howard B. Burchell, Earl H. Wood and Arthur H. Bulbulian. Springfield, Ill.: Charles C Thomas, Publisher, 1954. Pp. 202.

This atlas is an enlarged second edition of "Congenital Anomalies of the Heart and Great Vessels" (Dry and others: Springfield, Ill., Charles C Thomas, Publisher, 1948).

Many new features have been added in the present atlas. This atlas, which contains magnificent photographs, presents in a condensed form the main gross anatomic and cardiac physiologic aspects of congenital anomalies of the heart and vessels.

A number of photomicrographs demonstrate secondary changes in small vessels of the pulmonary circulation.

The atlas does not pretend to be a textbook on congenital malformations, but it is an excellent summary, with a happy combination of clinical and pathologic data. It will be of great value to the experienced pathologist in evaluating congenital malformations, as well as to the cardiologist, who is interested in congenital lesions of the heart and vessels.

An extensive bibliography, although not complete, gives the most important references for further study of the subject. The young resident in pathology or cardiology will do well to study first the more extensive textbooks and use this atlas after he has [illegible]tered the sometimes rather difficult t[illegible] of congenital malformations. The [illegible]longs in the library of every path[illegible] cardiologist and p[illegible]

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**Chylothorax and Its Treatment.** Le chylothorax et son traitement). Picard-Leroy, G., Presse Méd. 62:61, 1954.

Traumatic chylothorax is very rare, but the increasing frequency of intrathoracic operations has made chylothorax a not uncommon complication.

The most frequent cause of postoperative chylothorax is section of pleural adhesions and the endoscopic division of bands following artificial pneumothorax. It may also complicate pneumonectomy, thoracic sympathectomy, splanchnicectomy, phrenicectomy, stellectomy, esophagectomy, etc. On the other hand, posttraumatic chylothorax is rare because of the depth and protection of the thoracic duct. Spontaneous chylothorax has been observed in cases of mediastinal tumors, tuberculous fibrosis and aneurysm of the ductus. In children there may also be a strange "hygroma" of the duct without apparent cause.

Treatment must first aim at restoring the electrolyte balance and nutrient intake. Some authors reintroduce the chyle, aspirated from the pleural cavity, by intravenous injections. Such aspirations may be helpful, but most often surgical treatment is necessary. The duct is ligated after direct thoracotomy. (The different approaches are discussed.) For bilateral chylothorax with ascites the right-sided route at the level of the eighth rib is preferable. Reimplantation of the duct into a vein has also been tried successfully.

S. A. GUENKDJIAN, M.D.

**Selective Surgery for Peptic Ulcer.** Johnson, H., and Daintree, O. I. M., Surg., Gynec. & Obst. 98:425, 1954.

The authors, in attempting to find a better operation for gastric and duodenal ulcers, interviewed 823 patients on whom gastric operations or vagotomy had been done twelve months or more previously. Ninety-six per cent of the patients were traced, and most had been interviewed at regular intervals.

They also interviewed 108 patients who had undergone vagotomy alone five to eight years earlier. Just under 60 per cent received lasting benefit and have led normal lives, free from restraint, ever since, though only 33 per cent are altogether symptom free. However, 25 per cent have had to be advised to undergo further surgical treatment, and the remaining 15 per cent, though a little improved and not requiring a second operation, still need medical care.

The authors were not satisfied that they should continue to advise patients to undergo an operation, however safe, which could afford them no better chance of permanent relief than 60 per cent.

It was apparent from their studies of vagotomy that: hypersecretion of hydrochloric acid is checked; the course of the ulcer disease is profoundly modified; clinical failures are caused by scarring, duodenal obstruction and gastric retention; gastric ulcers have occasionally followed vagal resection, recurrent duodenal ulcers are uncommon; the unpleasant side effects of vagotomy, such as diarrhea and malodorous belching, tend to clear up in the course of weeks or months; all symptoms regarded as side effects of vagotomy are much less frequent after combined operations.

Both these authors and others have observed the successful use of vagotomy for gastrojejunal ulcers after earlier inadequate gastrectomy. In their opinion, therefore, it might prevent them if added to such limited gastrectomies in the first place, and they advocate the combination of vagotomy and two-thirds gastrecomy. They hope to achieve effective prevention of recurrent ulcer, such as is gained by radical five-sixths to seven-eighths resection alone, and at the same time win symptomatic results such as go with limited gastrectomy.

Vagotomy plus two-thirds resection in all cases of duodenal ulcer is advocated whenever the bulked twelve-hour gastric night secretion aspirated by continuous suction contains more than 20 milliequivalents of hydrochloric acid. The authors also accept more than 45 units of free hydrochloric acid or more than 65 units of total acid in the bulked juice as evidence of hypersecretion.

Vagotomy with gastroenterostomy is reserved for patients with duodenal ulcer in whom, on account of obesity, emphysema or old age, gastrectomy might be unduly dangerous.

Vagotomy alone has continued to be useful for patients with anastomotic ulcers after earlier gastrectomy, for the operative mortality rate of a second gastric resection is high and the further recurrence of ulcer after it is discouragingly frequent. Vagotomy was occasionally used, too, for recurrent ulcers which had followed gastroenterostomy when the ulcer was small, there had been no hemorrhage, the stoma was unobstructed and well placed, and there was not adhesion to the colon, if the patient was elderly or a bad surgical risk.

The vagotomy is done before the gastric resection. The authors regard the Billroth I method of anastomosis after gastric resection, with reestablishment of gastroduodenal continuity, as the operation of choice for patients with gastric ulcers. They do not attempt to use the Billroth I gastrectomy when the duodenal wall is the site of ulceration or scarring.

In the majority of cases of duodenal ulcer, the authors have performed a Polya gastrectomy, resecting about two-thirds of the stomach. The afferent loop of jejunum is taken to the lesser curvature and a Hoffmeister spur is made, leaving a small stoma, no wider than a dilated jejunum, at the end of the greater curvature. One of their associates has tried a number of left to right anastomoses with the spur still at the side of the lesser curvature in the hope of further hindering the too often precipitate emptying of the gastric stump. They prefer to carry the jejunal loop in front of the colon, where it lies comfortably across the splenic flexure, and they make the afferent loop long enough to prevent sagging or dragging.

The mortality rate for over 823 consecutive cases during the past six years is 1.5 per cent. Of 670 patients for whom the authors' policy for selection was used, 18 per cent complained of colic, 14 per cent of vomiting or regurgitation of bile, and 18 per cent of dumping or hypoglycemic syndromes. All the patients were asked, taking everything into consideration, "Do you think that since your operation you are (1) normal and apparently cured, (2) a lot better, but not normal, (3) only a little better, or (4) no better at all? In the group of patients in whose cases the authors' policy for choice of operations was followed, 60 per cent placed themselves in Category 1, 34 per cent in Category 2, 4.5 per cent in Category 3, 1.5 per cent in Category 4. On the other hand, patients on which a radical gastrectomy had been done were distributed as follows: Category 1, 4.2 per cent; Category 2, 47 per cent; Category 3, 2.9 per cent, and Category 4, 2.3 per cent. The authors conclude that their choice of operation gives somewhat better results than that of radical gastrectomy alone.

HENRY J. ROSEVEAR, M.D.

**Preservation of Corneal Grafts by Freezing.** Eastcott, H. H.; Cross, A. G.; Leigh, A. G., and North, D. P., Lancet 1:237, 1954.

Difficulty often arises in obtaining suitable corneal material for homografting in man at the precise moment it is needed. In a series of 12 cases the authors have proved that corneal grafts can be taken from cadavers and stored, by freezing, indefinitely.

The grafts were placed in sterile bijou bottles and covered with an excess of 15 per cent Glycerol in Ringer Saline (PHG). After thus standing for one hour at room temperature, the Glycerol-Saline was decanted, leaving just enough to cover the graft. The screw-cap was tightened and the bottles immersed in a container of carbon dioxide and alcohol freezing mixture at 79 degrees C. They are subsequently stored at this temperature after being transferred to a dry container. Both containers were kept surrounded with solid carbon dioxide, held in a lagged "perspex" box in a standard deep freeze.

Thawing was rapid in all cases, the bottle being immersed in a water bath at 40 C. and removed as soon as the graft was seen to be thawed.

Partial thickness grafts gave results that equaled those obtainable with fresh material. Full thickness grafts were less satisfactory, and all showed some opacification.

CLAUDE M. WARREN JR., M.D.

**Gallbladder Disease in Adolescents and Young People.** Griffin, G. D. F., and Smith, L. A., J.A.M.A. 154:731, 1954.

This study of residents of Rochest
(population 30,000) was undertake
to document the suspicion that the
encountered types of dder
may occur at any age
bers of p

It is true that a majority of patients who have disease of the gallbladder are over the age of 40. Nearly a third of the patients whose cases were collected however, were below this so-called typical age, and there were as many patients between the ages of 26 and 30 as between 41 and 45.

The diagnostic importance of a familial background of gallbladder disease is emphasized particularly when the examiner can rid himself, as the authors advise, of obsolete aphorisms suggesting that youthfulness is incompatible with cholecystitis.

Although it is recognized that cholecystic disease is a complication in more than 50 per cent of patients with congenital hemolytic disease, it does not follow that a majority of adolescents and young adults who have cholecystitis also have congenital hemolytic icterus.

The authors' statistical study indicated that neither congenital hemolytic icterus nor pregnancy can be regarded as a prime cause of cholecystitis in adolescents or young adults.

THOMAS WILENSKY, M.D.

**A Clinical Report on the Cytologic Diagnosis of Gastric Cancer.** Grimes, O. F.; Traut, H. F.; Wood, D. A., and Farber, S. M., Sur., Gynec. and Obst. 98:347, 1954.

In the crucial early stages of gastric cancer, when the results of roentgenologic study were negative or equivocal, cytologic procedures have permitted positive diagnosis after all other methods had failed. Investigators at University of California Hospital have developed a gastric lavage technic in which papain is used to penetrate the "mucous barrier" in which the desquamated cellular material is largely concentrated.

Experience with this method has indicated that very small gastric cancers, like pulmonary cancers, may exhibit exfoliated diagnostic cells in great numbers.

The authors suggest that, because of the well-recognized tendency of papillomas and gastric ulcers to malignant degeneration, it would seem wise to make periodic cytologic studies of all patients known to have either disease.

Cytologic diagnosis may be the only method of recognizing some gastric cancers while they are in a stage in which surgical treatment may effect long-term cures.

In the authors' opinion, cytologic studies must not be omitted when gastric complaints are encountered in patients who are over 50 years of age and in whose cases it is not possible to arrive at a diagnosis by the usual methods.

THOMAS WILENSKY, M.D.

**Chirurgie intracardiac à coeur exsangue sous hibernation artificielle (Intra-Cardiac Surgery on Exsanguinated Heart Under Artificial Hibernation).** Laborit, H.; Jaulmes, C., and Kunlin, J., Bordeaux Chir. 4:177, 1953.

Laborit was the first to introduce artificial hibernation. Without any "refrigerating" agents and by the sole use of drugs causing diminished hemogenesis and increased thermolysis the authors have been able to keep dogs at a temperature of 28C. Their pharmacodynamic "cocktail" is alone responsible for this hypothermia; it diminishes the *cellular* vital processes (histoplegia). Thus these experiments differ from those of Bigelow, Crawford and others.

Ganglioplegic preparations have been used for neuro-endocrine blockage, but the authors look forward to a new era of "neuroplegic" drugs with multifocal vegetative, ganglionic, central and peripheral activity, opening new possibilities of "histoplegia"—cell rest and even inhibition of cellular exchanges. On this basis the authors have attacked the problem of cardiac operations with the patient in artificial hibernation.

That which kills the homeothermic mammalian is the disorderly organic reaction to aggression. The drugs used block the endocrine, neurovegetative and homeostatic systems and in the meantime diminish cellular activity. It is a form of general hypobiosis, most marked in cerebral tissue. During artificial hibernation there is no need for carbohydrates and the proteins can look after the diminished needs. The authors have noted that more cellular proteins can be furnished by mobilizing the energy inherent in fat when the pituitary somatotropic hormone is administered.

This has opened new possibilities in cardiac surgery. Exsanguination throws the heart into fibrillation, often irreversible. By the use of pituitary somatotrophin and pharmacodynamic hibernants the authors were able to overcome fibrillation. During this cardiac "arrest" the heart lives in anerobiosis. A cardiac operation is then possible —and safe—in a bloodless field, and the Laborit technic has already been used by many surgeons.

S. A. GUEUKDJIAN, M.D.

# The Journal of the International College of Surgeons

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## CONTENTS—SEPTEMBER, 1954

---

Carcinoma of the Jejunum: Report of a Case .................................... 229
*Max Thorek, M.D., F.I.C.S., Chicago, Illinois, and Hellmuth H. Chiari, M.D., Vienna, Austria*

Alloplastic Bone Graft Used Experimentally .................................... 238
*Alexander Lichtor, M.D., F.I.C.S., Kansas City, Missouri*

A Method of Restoration of the Bile Flow after Damage
*H. J. McCurrich, Hove, Sussex, England*

Avulsion of Central Third of the Face: Report of a Case........................ 247

*Alma Dea Morani, M.D., Philadelphia, Pennsylvania*

Combined Abdominal and Right Thoracic Approach to Lesions of the Middle and Upper Thirds of the Esophagus, and its Immediate Results ........................ 253

*Shigetsugu Katsure, M.D., F.I.C.S., and Yoshinobu Ishikawa, M.D., Sendi, Japan*

Anomalous Conditions Affecting the Urinary Tract ........................ 261

*Lowrain E. McCrea, M.D., F.A.C.S., F.I.C.S., Philadelphia, Pennsylvania*

Electric Shock to Change Ventricular Fibrillation into Normal Cardiac Rhythm: Experimental Studies and Clinical Experiences........................ 265

*Shigeru Sakakibara, M.D., F.J.S.A., F.I.C.S., Kusuo Iwamoto, M.D., Yoshie Matsubara, M.D., and Kenji Minagawa, M.D., Tokyo, Japan*

Intestinal Fistula ........................ 278

*Mark Mozes, M.D., Lt. Col., Tel Aviv, Israel*

Diced Cartilage Grafts ........................ 283

*Lyndon A. Peer, M.D., F.A.C.S., F.I.C.S., Newark, New Jersey*

Treatment of Complete Rectal Prolapse with Sclerosing Agents ........................ 292

*J. Gerendasy, M.D., F.A.P.S., F.I.C.S., Elizabeth, New Jersey*

Safeguards in Total Abdominal Hysterectomy........................ 299

*Marion B. Noyes, M.D., F.A.C.S., F.I.C.S., D.A.B., Charles H. Lithgow, M.D., and George E. Spaulding, M.D., Salt Lake City, Utah*

Method of Measuring the Length of the Bones........................ 308

*Guillermo M. Pujadas, M.D., F.I.C.S., Sarasota, Florida*

SECTION ON OPHTHALMOLOGY AND OTORHINOLARYNGOLOGY

Solo Technic in Ophthalmic Surgery........................ 312

*Naumann T. Mascati, D.O.M.S., A.I.C.S., Surat, India*

EDITORIALS

An Evaluation of the Surgical Approach to the Duodenal Ulcer Problem........... 320

*R. R. Coffey, M.D., Kansas City, Missouri*

Surgical Progress in Argentina........................ 324

REVIEW OF ARGENTINE SURGICAL LITERATURE, FIRST HALF OF 1954........................ 325

NEW BOOKS ........................ 366

COLLÈGE INTERNATIONAL DES CHIRURGIENS
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Vol. XXII SEPTEMBER, 1954 No. 3

# *Original Articles*

## Carcinoma of the Jejunum

### Report of a Case

MAX THOREK, M.D., F.I.C.S.
CHICAGO, ILLINOIS
AND
HELLMUTH H. CHIARI, M.D.
VIENNA, AUSTRIA*

PRIMARY malignant lesions of the small intestine are admittedly rare. Sorlin in 1824 wrote the first article on carcinoma of the jejunum. Leichtenstern reported that malignant lesions of the small intestine form 0.095 per cent of all malignant lesions of the entire gastrointestinal tract. Maydl estimated this figure at 0.029 per cent, Nothnagel at 0.051 per cent. Reviewing the literature, one finds that carcinoma of the intestine accounts for between 0.029 and 6 per cent of all gastrointestinal malignant lesions (Barsch,[1] Ewing, Forgue and Chauvin; Pridgen; Mayo and others;[2] Raiford, Christofferson and Jacobs); the general average of cases described is 3 per cent. In a recent review (necropsy report of 9,866 cases) on carcinoma as the cause of death in the hospitals of Vienna during 1950,[7] carcinomas of the small intestine, 3 in male and 4 in female patients, excluding carcinoid tumors, were observed in a total of 2,306 carcinomas (0.3 per cent); 781 carcinomas of the entire gastrointestinal tract (0.89 per cent), and 319 carcinomas of the intestinal tract (2.32 per

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From the Department of Surgery, American Hospital of Chicago.
Submitted for publication March 26, 1954.

cent). Henke and Lubarsch,[3] in their textbook on specific pathologic anatomy and histology, stated in 1929 that malignant lesions of the small bowel form 1.3 per cent of all malignant lesions of the intestinal tract. It was pointed out by Barsch,[1] the incidence of malignant disease of the small bowel is on the increase as reflected in the American and European literature; this is perhaps largely due to improved diagnostic methods and renewed interest in the subject.

An exhaustive review of the incidence as related to sex, roentgenographic and clinical observations, pathologic picture, treatment and prognosis in 63 cases of carcinoma of the jejunum and ileum surgically treated at the Mayo Clinic from 1907 through June 1947, meticulously correlated with cases found in the literature, was given by Pridgen, Mayo and Dockerty[2] in 1950. The report of our additional case seems important in that it calls attention to this admittedly rare malignant lesion, brings the total incidence up to date, and reviews the significant symptoms and signs, which are often misinterpreted or overlooked.

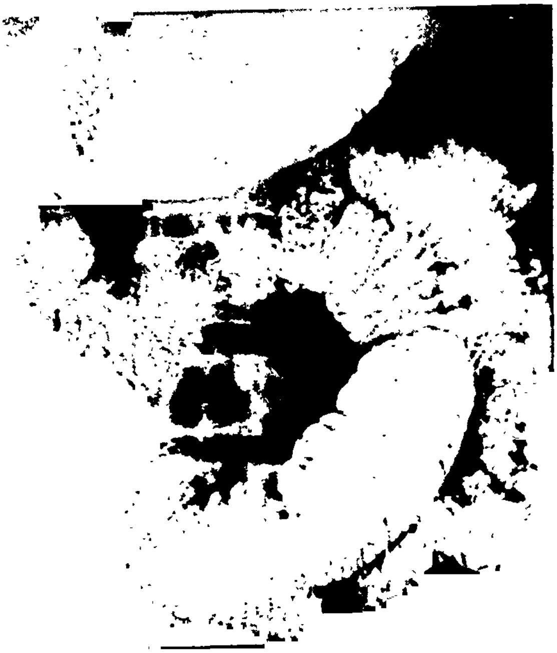

Fig. 1.—Stomach, duodenum and proximal jejunal loops. Jejunum is markedly distended.

## REPORT OF CASE

H. D., a 36-year-old white man, eleven months prior to his admission to the hospital, felt extremely exhausted, weak and continuously tired. General examination in May 1953 revealed anemia (hemoglobin 37 per cent [5.1 Gm.]). The erythrocyte count was 2,850,000, and the leukocyte count 13,200, per cubic millimeter of blood.

Roentgen examination of the gastrointestinal tract and the kidneys disclosed no abnormality; examination of the bone marrow also gave negative results. The anemia was treated by the usual iron-liver therapy, and during the following months the patient felt much better. In September 1953 he noticed for the first time a peculiar fullness in the umbilical region and the right lower abdominal quadrant, accompanied by increasing weariness, weakness and fatigue. Simultaneously he noticed dark or black stools. Subsequently the peculiar sensation culminated in abdominal pains around the umbilicus, radiating to the right side and the back, varying in severity and character, but mostly cramplike. Those occurred several hours after eating; in the patient's opinion this was not related to the type of food taken; he always enjoyed a good appetite and never complained of gastric disturbances. The symptoms were noted during defecation, when he passed flatus or belched gas. A second roentgen examination of the gastrointestinal tract (December 22) revealed distention of the proximal jejunal loops, suggesting a lesion of the small bowel. The patient was admitted for further examination on December 28.

*History.*—The patient had 10 brothers and sisters; 2 had died at an early age, and all others were well. There was no history of previous diseases or major operations. The patient's father was 65 years old and well; his mother, 62 years of age, had complained of gastric symptoms for several years, but had refused to consult a physician. Her father had died, about thirty years earlier, of a gastric ailment, which the patient stated was a cancer.

The patient had had mumps, chickenpox and whooping-cough in childhood. During military service he was admitted for a couple of weeks to an army hospital in the South Pacific theatre because of high fever; in his opinion it was malaria. The symptoms had persisted. In 1947 he underwent a hemorrhoidectomy. Otherwise he was never ill.

The patient did not smoke; he drank occasionally (beer and wine). He denied that he had ever had venereal disease. There were no urinary disturbances. The bowel movements were normal, with no constipation or diarrhea, but the stools were dark or black. He had lost about 5 pounds (2.3 Kg.) during the last few weeks prior to admission to the hospital.

*Examination.* — Physical examination revealed the patient to be well built and muscular. He weighed 185 pounds (83.9 Kg.) and was 5 feet 10 inches (177.8 cm.) in height. *There was no abnormality except in the abdomen, which revealed a painless immovable* area of moderate resistance in the right lower quadrant, approximately in the midline between the umbilicus and McBurney's point. There was no distinctly palpable mass and no visible peristalsis, nor was succussion or any other sign of obstruction present. The liver and the spleen were not palpable, and the abdomen was, except for the local resistance and tenderness, normal. There were no signs of free fluids.

The blood count revealed hypochromic anemia, with 6.3 Gm. of hemoglobin (44 per cent). The erythrocyte count was 3,000,000, and the leukocyte count 7,000, per cubic millimeter of blood. The differential count was normal. The benzedrine test for blood in the stool gave a strongly positive reaction. Urine examination and serologic tests (Kahn) gave negative results.

A chest roentgenogram revealed no significant abnormalities. In reexamination of the gastrointestinal tract, the distention of the proximal jejunal loops observed ten days earlier could not be detected. The small bowel evacuated the barium meal within an hour; after four hours the colon was filled. At the same time, marked spasticity of the pylorus and duodenum was observed, so that an inflammatory process in that region was suspected. An ulcerous niche, however, could not be detected. The appendix was long and distended but in normal position. There was no sign of disease of the colon.

The patient had no fever; his blood pressure, pulse rate and respiratory rate were normal. Preoperatively he was given 4 pints of blood after which the hemoglobin content rose to 68 per cent (10.6 gm.), the erythrocyte count to 3,320,000 and the leukocyte count to 16,000. Multovitamin-feasol therapy was also given. Operation was performed on the tenth day after admission.

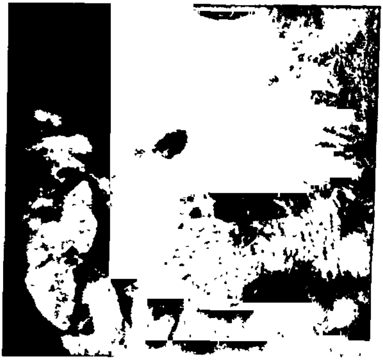

Fig. 2.—Film taken four hours after intake of the barium meal. Part of the contrast medium has reached the colon. The distended proximal jejunal loops are still visualized.

*Operation.* — Premedication (scopolamine, gr. 1/200) was given an hour and a half before operation. Anesthesia was induced with cyclopropane and continued with a cyclopropane-ether mixture by orotracheal intubation. A small amount of anectine was used to provide better relaxation. During the operation patient was given 1,000 cc. of blood and 500 cc. of 5 per cent dextrose in water. The blood pressure, pulse rate and respiratory rate were always essentially normal. The patient was conscious at the end of the operation, and all reflexes were present (Chiari).

The abdomen was opened (Thorek) through an upper middle right rectus incision. Exploration of the contents of the upper abdominal cavity revealed that the proximal jejunal loops were displaced to the lower part of the right side and adherent, suggesting an intra-abdominal hernia. Further exploration revealed a tumor of the proximal jejunal loop, 10 to 15 cm. below the ligament of Treitz. There was penetration of the jejunal lesion, which was attached at the point of penetration to the mesentery of the lower portion of the ileum. In an attempt to free the bowel from its attachment, the tumor was broken through and opened into the lumen of the small bowel. *The neoplasm and about 30 cm. of the jejunum* with its mesentery were resected, the ends closed and a side-to-side anastomosis performed. A trian tery of the lower part of the ileum invaded by the tumor was resected, and the opening was closed by interrupted sutures. The blood supply of the regional part of the ileum after this resection seemed adequate. The abdominal wall was closed in layers.

*Pathologic Observations.* — The specimen consisted of a segment of jejunum measuring approximately 30 cm. in length. In the center a bulging firm tumor mass was present, measuring 5 cm. in its largest diameter. The anterior surface of the bowel wall showed an irregular defect measuring 2 by 1.5 cm. In addition there existed a globular mass of omental fat tissue measuring 4 by 3 by 1.5 cm., the surface of which was infiltrated with grayish hemorrhagic tumor tissue. This apparently formed part of the anterior wall of the jejunum, where the aforedescribed defect had been discovered. The specimen when opened revealed marked dilatation of the lumen of the jejunum proximal as well as distal to the tumor mass. On examination the tumor showed a craterlike ulcerated surface. The cut section invaded the entire thickness of the bowel wall and, in addition, extended into the contiguous

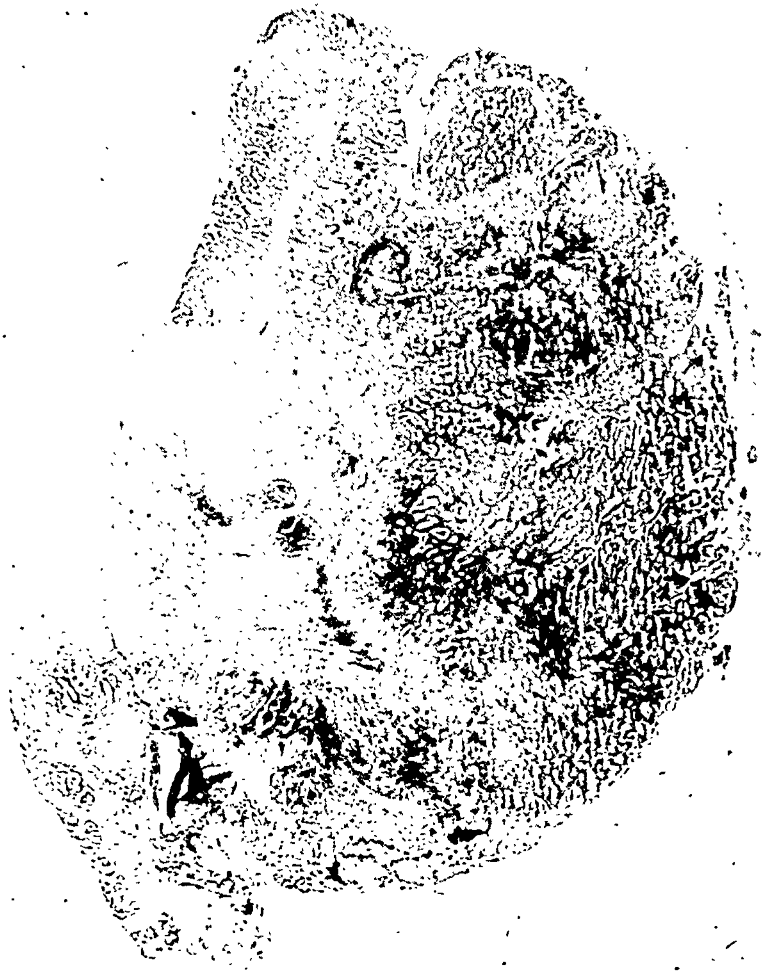

Fig. 3.—Transition from normal to tumor growth (scanning view).

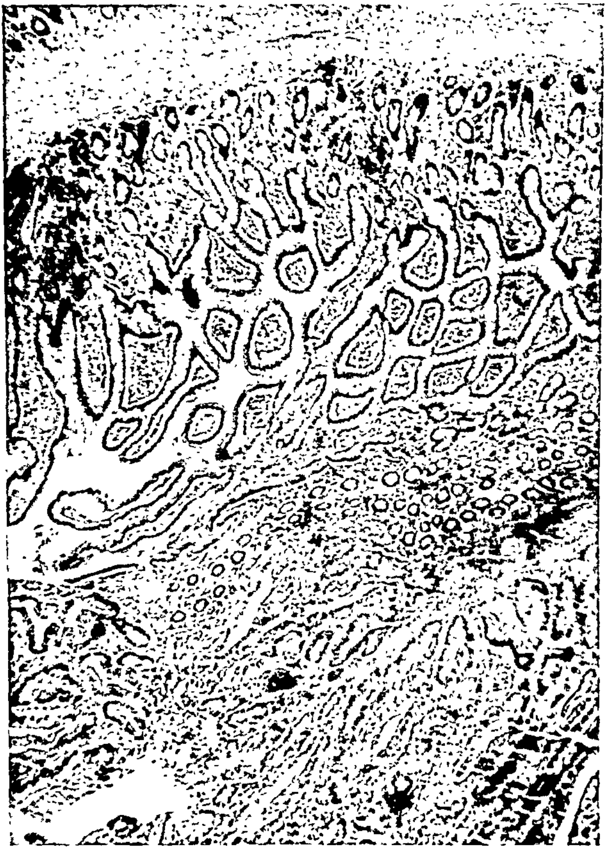

Fig. 4.—Same as Figure 1, in higher power magnification.

portion of the mesentery.

Histologically, sections from the tumor mass revealed a growth composed of large masses of irregular glandlike structures lined with atypical epithelial cells. The surface of the tumor was ulcerated. The growth invaded the entire thickness of the bowel wall and extended into the aforedescribed fatty tissue. Laterally it infiltrated the deeper layers of the bowel wall, beneath an intact mucosa. Sections through the mesentery revealed metastatic tumor tissue corresponding to this description.

The pathologic diagnosis was adenocarcinoma of the jejunum with metastases to the regional lymph nodes.

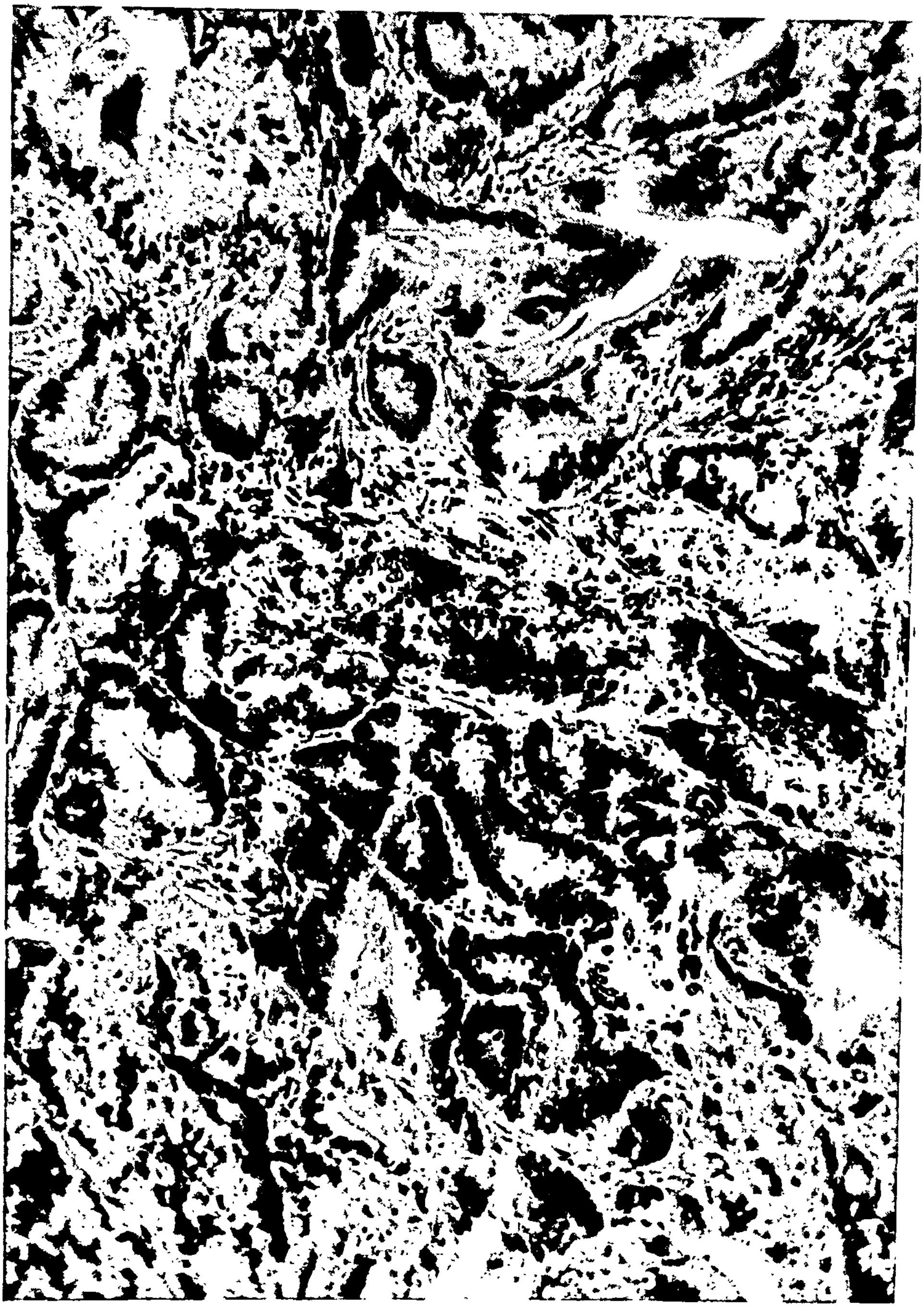

Fig. 5.—Tumor proper (high power magnification).

*Course.*—The postoperative course was uneventful. The patient was given the normal amount of fluids, antibiotics and vitamins. A Levine tube was in place until the second postoperative day; catheterization was necessary during the first 24 hours. The temperature rose only on the first postoperative day to 100.4 F.; the following days it was normal. The patient was discharged on the tenth postoperative day, in good general condition.

## COMMENT

As has been stated, an exhaustive review of the literature on carcinoma of the jejunum and ileum was presented by

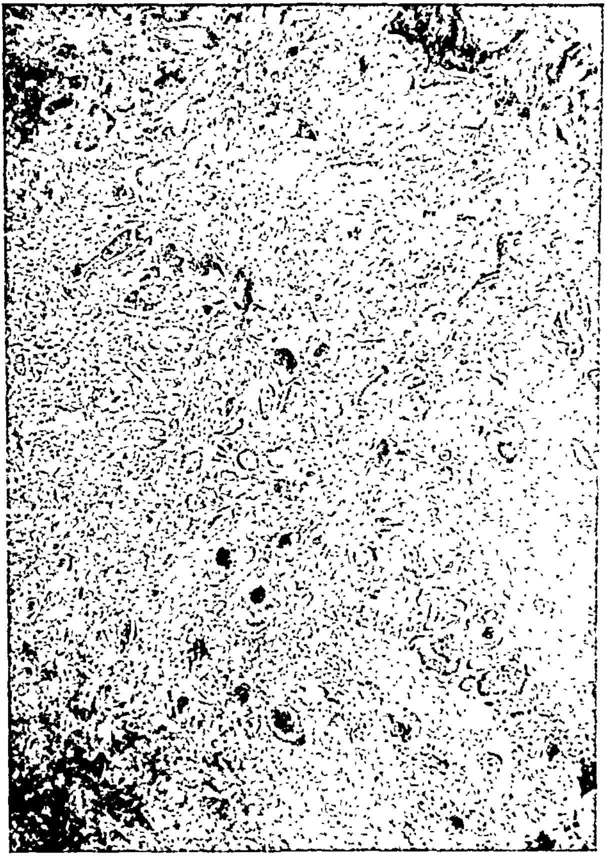

Fig. 6.—Infiltrating growth in mesentery (low power magnification).

Pridgen, Mayo and Dockery[2] in 1950. They described a triple symptom complex for such lesions: anemia, obstruction and perforation. These occur in a high percentage of cases. In the case here reported, anemia was present when the patient was hospitalized for the first time (May 1953); roentgenographic examination of the gastrointestinal tract at that time revealed no pathologic change. The patient complained only of weakness and fatigue, symptoms that are characteristic of any type of anemia, and the usual antianemic therapy brought relief from these disturbances. In September 1953 the patient first noticed the sensation of a "foreign body feeling," and later he perceived pains in the right lower abdominal quadrant (a location which usually points to the appendix) and around the umbilicus. Pridgen and his associates stated that pains caused by such malignant lesions occur mostly in the left lower abdominal quadrant and around the umbilicus; however, the attachment of the tumor to the mesentery of the right lower abdominal quadrant, observed at operation, explains the cause of the pains on the right side.

A noteworthy point, however, should be emphasized: Roentgenographic examination of the gastrointestinal tract on December 22 revealed distention of the proximal jejunal loops, suggesting an obstructive lesion — and ten days later a second roentgenographic examination, intended to corroborate the previous impression of pathologic involvement of the jejunal loops, failed to do so. The barium meal passed through the small bowel within an hour; only marked spasticity of the pylorus and the duodenum, suggesting a possible inflammatory process in that region, was observed. The penetration of the lesion, supposed to produce the "perforative syndrome" and responsible for the detachment to the mesentery, was not complained of by the patient. Finally, another major symptom of malignant change — loss of weight — was entirely absent.

## SUMMARY

A case of adenocarcinoma of the jejunum is reported in which, despite the presence of the full pathologic triad, anemia, obstruction and perforation (Pridgen and others), the lesion was not recognized before operation. The reason was that only anemia was manifest. The two other features (obstruction and perforation) could not be definitely established by clinical and roentgenologic study.

## ZUSAMMENFASSUNG

Es wird über einen Fall von Karzinom des Jejunums berichtet, der trotz Vorhandensein der vollen Trias (Pridgen u.A.) vor der Operation nicht erkannt worden war. Der Grund dafür war, dass die Anämie das einzige manifeste Krankheitszeichen war; die beiden anderen (Obstruktion und Perforation) konnten weder klinisch noch röntgenologisch mit Sicherheit nachgewiesen werden.

Peer

L'autore descrive una tecnica personale per l'esecuzione di trapianti cartilaginei, da lui impiegati per primo allo scopo di colmare depressioni delle ossa craniche, difetti della faccia e nella ricostruzione dell'orecchio. Egli suggerisce di impiegare detti trapianti anche per altri scopi. Sono preferibili trapianti cartilaginei autogeni, per quanto ben tollerati siano anche trapianti prelevati da cadaveri e conservati in apposite banche. Le altre indicazioni sono: la riparazione di vaste perdite di sostanza della parete toracica, di ernie dell'addome e di estese perdite di sostanza della colonna vertebrale e di altri segmenti scheletrici nell'infanzia e nella giovane età.

## RESUMEN

Se comunica un caso de carcinoma del yeyuno en que a pesar de la presencia de la tríada patológica completa (Bridgen y col.), la lesión no fué reconocida sino hasta después de la operación. La razón de esto, es que solamente se encontraba anemia, los otros dos fenómenos (obstrucción y perforación) no pudieron ser establecidos en forma definida por el examen clínico y el estudio roentgenográfico.

## RIASSUNTO

Viene descritto un caso di carcinoma del digiuno che, nonostante la presenza della triade sintomatica caratteristica (Pridgen e al.), non fu diagnosticato preoperatoriamente perchè, dei tre sintomi, soltanto l'anemia era manifestamente presente mentre lo stato occlusivo e la per-

forazione non poterono essere altrettanto chiaramente accertati con l'osservazione clinica e con gli studi radiologici.

### RÉSUMÉ

Les auteurs rapportent un cas de carcinome du jéjunum, dont la présence n'avait pas pu être révélée avant l'opération malgré la triade pathologique Pridgen. L'anémie seule était apparente, les deux autres signes (obstruction et perforation) ne purent pas être établis définitivement par l'examen clinique et radiologique.

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Those who have suffered much have lived long. Never suppose that lonely spirits know nothing of the world; they see and judge it.

It is the misfortune of a usurper that he is bound to have two sets of enemies, those who gave him his crown and those from whom he took it.

A courage which looks easy and yet is rare; the courage of a teacher repeating day after day the same lessons—the least rewarded of all forms of courage.

Flatter the passions of the day, and you immediately become a hero.

A creature and a creator! There lies the whole difference between one man and another.

—*Balzac*

# Alloplastic Bone Graft Used Experimentally

ALEXANDER LICHTOR, M.D., F.I.C.S.

KANSAS CITY, MISSOURI

BONE grafting plays a vital role in the surgical treatment of certain conditions of the extremities and spine and may be essential to the treatment of established nonunion and delayed union of fractures, after osteotomy, open reduction of certain types of recent, unstable and infected fractures, elimination of joint motion in the presence of pain or disease and filling in after removal of benign bone tumors. Removal of an autoplastic bone graft from a donor site adds to the already present problem by further mutilation of the patient as well as an increase of operating time; also, the possibility of infection is increased, and if the donor site is a long bone the latter may fracture.

The procedure of replacing lost parts of bone with bone from the same person is termed autoplastic. When the transplanted bone comes from one of the same species the method is known as homoplastic, and if the bone is grafted into one of a different species it is called heteroplastic. An alloplastic graft is a substitute, e. g., a graft made up of a mixture of calcium salts. It would seem that the ideal graft, possible in the future, is an absorbable alloplastic graft, one that is strong, inexpensive to manufacture, easily sterilized and, most important, well tolerated by living tissue.

It may be presumed that the most important function of the alloplastic material is to stimulate proliferation of bony tissue and that calcium salts may act as a stimulus for the differentiation of osteoblasts from proliferating connective tissue.

*Method of Preparing the Graft.*—An alloplastic graft was made in such a manner as to approximate the chemical and physical characteristics of bone. One of the formulae given for bone is as follows: organic matter 31.03, calcium phosphate 58.23, calcium carbonate 7.32, calcium fluoride 1.41, magnesium phosphate 1.32 and sodium chloride 0.69. The organic matter is described as gelatin or gelatin-like.

1. Granular gelatin was used for the organic matter. The mineral salts in the aforementioned proportions were added, and the mixture was gently heated after the addition of just enough water to make a thick paste. When dry, the resultant white mass was hard and insoluble in acetone and ether but unfortunately dissolved in hot water. In order to render the material more adaptable for use, formaldehyde was added to the warmed mixture. A small amount of formaldehyde exerts a preservative action on gelatin. When dry, the formogelatin is insoluble in either cold or boiling water. Dried or powdered formogelatin was used during World War I as an antiseptic dusting powder for wounds.

2. When a few drops of 10 per cent formaldehyde are added to a mixture of water, gelatin and inorganic salts, the material changes rapidly from a pasty to a rubbery texture. The latter, dried, was used as an alloplastic graft.

*Method of Experimentation.* — Guinea pigs were used. The lower thoracic laminae were curetted bilaterally in order to break up the superficial cortical bone. An alloplastic graft was placed next to the laminae on the left only, the other side being used for comparison. Fixation was secured by suturing the paravertebral muscles with cotton; the skin wound was also closed with cotton sutures. Twenty-

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The facilities of the Department of Anatomy, University of Kansas, Lawrence, Kansas, and the Department of Pathology, Menorah Hospital, Kansas City, Missouri, were used in this study.

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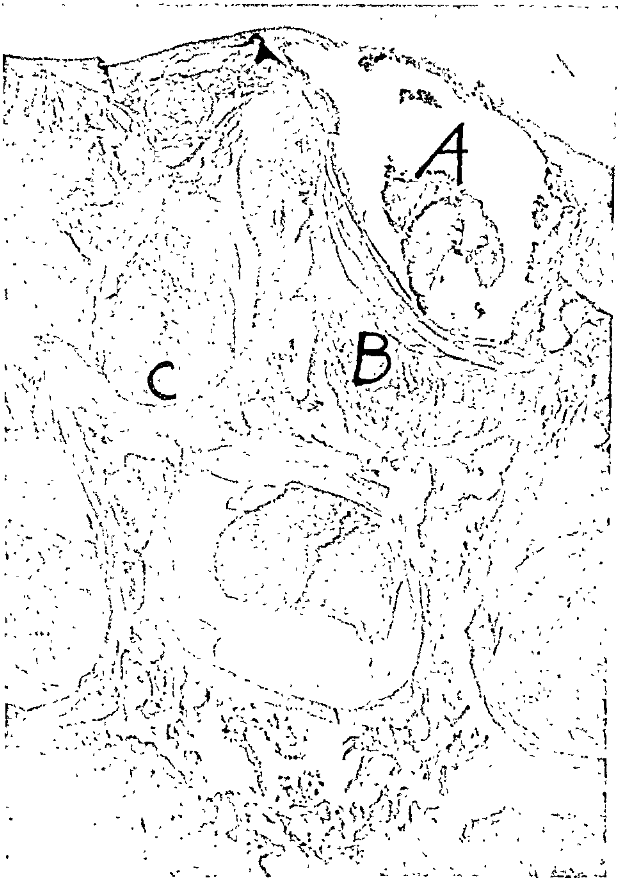

Fig. 1.—Section of experimental animal twenty days after operation. *A*, alloplastic graft; *B*, new bone proliferation; *C*, view superficial to curetted lamina on opposite side of *B*.

two animals were used and observed for postoperative periods up to three hundred days, the animals being killed at five-day intervals to one hundred days, then at two hundred and three hundred days. No infections were encountered.

*Microscopic Studies.*—The [illegible] areas in the [illegible]

Reaktionen des lebenden Gewebes hervor. An den Stellen, wo lebender flacher Knochen mit dem alloplastischen Transplantat in Berührung war, kam es zu reichlicher Bildung von fibrösem Gewebe und neuem Knochen. Diese Form des Knochentransplantats kam in verschiedenen Fällen, die zur Zeit weiter verfolgt werden, zur Anwendung.

Es wird angenommen, dass sich das Material zur klinischen Anwendung als Transplantat und möglicherweise auch als Stift eignet. Wenn man es vorzieht, kann man anstatt der Gelatine auch Kollagen oder kollagenartiges Material als Ersatz der organischen Knochensubstanz in Betracht ziehen.

## RESUMEN

Se hizo un injerto haloplástico a partir de sales inorgánicas del hueso mezcladas con gelatina, esta última tomando el lugar de la substancia orgánica del hueso. Se agregó formaldehido para esterilizar el material y hacerlo insoluble en agua. El hueso haloplástico fué barato y fácil de preparar. Se colocó unilateralmente sobre hueso laminar socabado de columna vertebral de cuyes. El lado opuesto fué socabado en forma semejante y usado como control. Postoperatoriamente no hubieron reacciones de cuerpo extraño a este material. En el sitio de contacto del hueso laminar y el injerto haloplástico se desarrollo tejido fibroso y hueso nuevo. Este tipo de injerto se ha usado en varios casos que se han seguido en su evolución.

Se sugiere que dicho injerto tiene aplicación clínica como injerto y posiblemente tambien como férula. Si se prefiere puede considerarse el uso de las substancias colágenas ó colagenoideas en vez de la gelatina como substitutas de la substancia orgánica del hueso.

## RIASSUNTO

Il trapianto era formato di sali inorganici di provenienza ossea mescolati a gelatina; quest'ultima rappresentava la parte organica. Si aggiunse formalina per sterilizzare il materiale e renderlo insolubile. Così preparato, il trapianto si dimostrò economico e facile da ottenere. Fu innestato in cavie sulle lamine vertebrali, previo raschiamento; il lato opposto fu preparato allo stesso modo perchè servisse come controllo. Il materiale si dimostrò ben tollerato dai tessuti; nei punti di contatto con il trapianto l'osso produsse tessuto fibroso e osso neoformato. I casi trattati sono tuttora in studio. Il metodo può trovare applicazioni cliniche. Al posto della gelatina si potrebbe usare collageno o sostanze simili.

## RESUMO

Um enxerto aloplástico foi conseguido de sáis minerais encontrados em ôsso misturado com gelatina, esta ultima substituindo a substancia orgânica do osso. Foi adicionada formaldeida para tornar o material esteril e resistente a dissolução pela agua. O enxerto osseo aloplastico é barato e facilmente preparado.

Foi praticada a experimentação em porcos da Guiné, não oferencendo ao posoperatorio qqualquer reação a receptividade dêsse material.

Pensa o autôr que êsse tipo de enxerto tera aplicação clinica, o que, aliás, é per êle sugerido.

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# A Method of Restoration of the Bile Flow After Damage to the Common Bile Duct

H. J. McCURRICH, B.S., M.S., F.R.C.S., M.R.C.O.G., F.I.C.S.
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IN January 1944 I published (Brit. J. Surg. 21:304) an account of an emergency repair of the common bile duct, in which a sleeve of mucosa from the duodenum was used to form the lower end of the common duct. The operation was performed in November 1942. This simple, rapid method enabled me to avoid retroperitoneal exploration of the bile ducts in a patient desperately ill from biliary peritonitis. It tided my patient over a grave emergency. She remained well for over a year, and I hoped that the result would be permanently satisfactory, but early in 1944 there developed irregular attacks of pyrexia and jaundice, with clay-colored stools. The liver became considerably enlarged. After some weeks an abscess in the scar of the original operation became manifest. The abscess was opened and drained. Bile accompanied the pus; a fistula was traced to the liver.

It was apparent that the patient had cholangitis and complete obstruction of the common bile duct. Her general health, which was poor, became much better after rest in the hospital, but the passage of clay-colored stools and bile in the urine continued, and there was a little bile-stained discharge from the old wound. Consequently, on Feb. 24, 1944, at the Royal Sussex County Hospital, I explored the subhepatic pouch at the site of the first operation (cholecystectomy) performed by a colleague at another hospital, with use of Kocher's incision. At the second operation I had employed an upper right paramedian incision. This incision was now excised. There was a biliary fistula from the old Kocher incision which could be traced to the biliary tract. There were many adhesions around the region of the common duct. Eventually the upper part of the common duct was located with an attached stenosed cord below it.

The lower end of the upper fragment of the common duct was divided above the stricture and the duct defined. The open end was about 0.7 cm. below the juncture of the two hepatic ducts. Two tubes about the bore of a Ryle tube and about the same length were employed, the end of each tube being passed up the remains of the common hepatic duct and then one of them passed into the right hepatic duct and the other into the left (see illustration, *1*). The fibrous remains of the mucosal tube fashioned in the emergency operation referred to were excised, and a window cut in the upper surface of the duodenum (*2*). An additional small window was cut in the anterior surface of the descending part of the duodenum. The two tubes were drawn into the duodenum through the top window and then out through the lower window (*2*). The upper window was then brought up to the liver, and the edges of the window were sutured with interrupted stitches of fine thread to the peritoneum over the liver in such a way that the cut end of the common duct and the emerging tubes lay in the middle of the window (*3* and *4*). The tubes were next brought through the great omentum (*5*) and out through the incision, the ends being put into a sterile bottle (*6*).

The patient was given a blood transfusion. Convalescence was smooth. The tubes were drawn out on the fifth postoperative day and the wound proved, as had been hoped, self-sealing, owing, in my opinion to the omental pad through w

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tubes had passed.

The abscesses in the Kocher incision healed, and the patient left hospital six weeks after the operation. Up to the time of writing, she has remained well except for some trouble with hemorrhoids, dealt with by injections in 1949. In 1954, ten years after the operation, she is in good health. Her present age is 58.

The second case was that of a patient at the Brighton General Hospital. In 1943, a man aged 62 underwent cholecystectomy for gallstones. This was followed by a biliary fistula and clay-colored stools. At the request of my friend and colleague, Mr. Powell, I explored the area, and found the divided end of the common hepatic duct. The operation aforedescribed was carried out. Three months later the patient was perfectly well. It was difficult to keep track of him, as he was of intemperate habit and apt to go off on a drinking bout. He was admitted to the medical wards of the Royal Sussex County Hospital in September 1948, and died in 1949 of arteriosclerosis and a gastric ulcer. A massive hemorrhage from this ulcer was the cause of death. He had jaundice, and was said to have become jaundiced six months after the repair operation. His right thigh had been amputated eight months before his death for arteriosclerosis and gangrene of his right foot. The postmortem summary, signed by Dr. R. W. P. Johnson—to whom I am grateful for permission to publish—reads as follows:

> "Huge ulcer at pylorus with large vessel in base, stomach and bowels full of blood, liver cirrhotic and bile-stained, small pigment stones in intrahepatic bile ducts, gallbladder missing, bile duct surrounded by adhesions, spleen firm and slightly enlarged, cystitis. Coronary arteries atheromatous but patent. Abdominal aorta and iliacs arteriosclerotic."

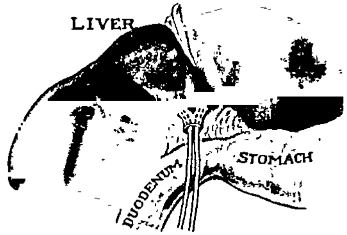
It is difficult to know whether stenosis of the hepatic duct had occurred or not. The presence of a large pyloric ulcer may have had an influence on biliary obstruction.

Mr. Powell informs me that he has used this method of repair in 2 additional cases, with satisfactory results, thus bringing the number of cases up to four.

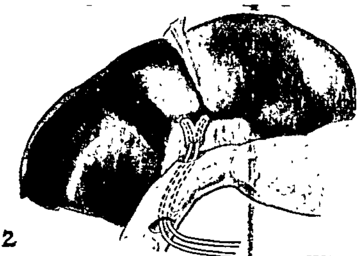
In the fifth case the method of bringing rubber tubes from the hepatic ducts through the duodenum and out through the second part through an omental "washer" was employed, but the common duct was united by end-to-end anastomosis (see illustration, *7* and *8*). The patient, a woman aged 46, was being operated upon by me for cholecystitis at the request of a medical colleague. The ducts were very small, and the bile duct was mistaken for the cystic duct, which was practically nonexistent. The duct of relatively small caliber that was thought to be the cystic duct appeared to run down to a large duct that was thought to be the common bile duct but in reality was the portal vein.

In inspecting the area after removal of the gallbladder I discovered what had happened—the divided common hepatic duct had retracted upward and was found with difficulty. Two tubes were passed with some difficulty into the right and left hepatic ducts. The posterior edge of the divided hepatic duct was sutured with interrupted fine thread to the posterior part of the common bile duct; a probe carrying a silk thread was passed down the common bile duct into the duodenum, and an incision was made in the second part of the duodenum over the point of the probe, which was then drawn out. The silk thread was attached to the two tubes, which were introduced with some difficulty into the rather narrow common bile duct. The tubes, by means of gentle pushing from above and pulling on the silk from

*Opposite*, successive stages of procedure described in text: *1*, two tubes passed through common hepatic duct into right and left hepatic ducts; *2*, tubes pulled through duodenal windows; *3*, upper duodenal window sutured to peritoneum; *4*, common hepatic duct with emerging tubes placed in middle of window; *5*, emerging tubes brought through great omentum; *6*, tubes brought through incision, to drain into sterile bottle; *7*, tubes passed through remnant of common duct (another case); *8*, end-to-end anastomosis of common duct.


LIVER
STOMACH
DUODENUM

1



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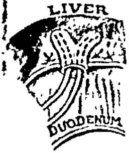
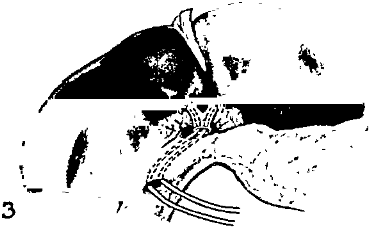

LIVER
DUODENUM



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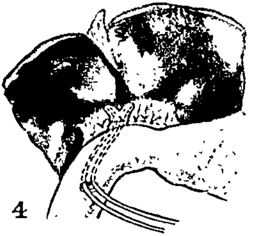

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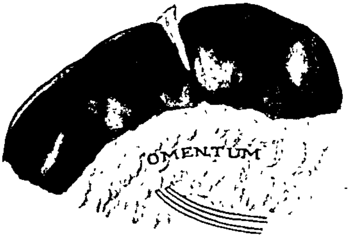
OMENTUM

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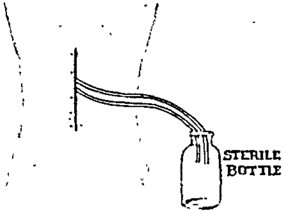
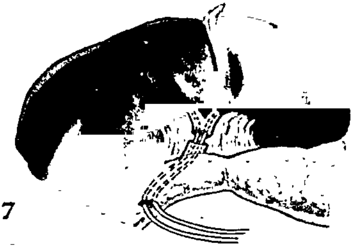

STERILE
BOTTLE

6



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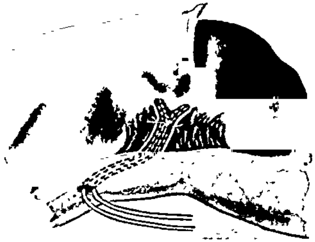

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below, were drawn out and passed through a hole made in the omentum. The anastomosis of the common duct was then completed; five interrupted fine thread stitches were used. The abdomen was closed, with the tubes passing to a bottle. A corrugated drain was put down to the area of the gallbladder bed. This was removed on the fourth postoperative day. The tubes to the hepatic ducts were removed on the seventh day. A little discharge followed for a few days. The patient left the hospital, healed, on the nineteenth day, and has remained well since.

The advantages of this operation are that drainage of the bile is under visual observation and can scarcely be obstructed, and stenosis is less likely than with an artificially reconstructed duct. When anastomosis is possible, the tubes form a splint around which it is easy to complete the anastomosis without contracting the lumen. The risk of leakage is diminished, and, owing to free drainage, even if the anastomosis were to break down even slightly, leakage of bile into the peritoneal cavity is unlikely to occur. No further operation to remove the tubes is required. No foreign substance (e.g., no vitallium tube), is left in the ducts.

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To me the charm of an encyclopedia is that it knows—and I needn't.
—*Francis Yeats-Brown*

Laughter is not at all a bad beginning for a friendship, and it is far the best ending for one.
—*Oscar Wilde*

There is a greater distance between some men and others, than between some men and the beasts.
—*Montaigne*

All who suffer are full of hatred: all who live drag a remorse: the dead alone have broken their chains.
—*Victor Hugo*

There are two sorts of ruins: one is the work of time, the other of men.
—*Chateaubriand*

# Avulsion of Central Third of the Face

## Report of a Case

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PHILADELPHIA, PENNSYLVANIA

THE objective of every plastic procedure involves a well-known dual responsibility on the part of the surgeon, i.e., to restore, to as near the normal status as possible, both the function and the appearance of the part involved. The surgeon's major thought in planning a reconstruction must thoroughly canvass the possibility of utilizing all avulsed tissues in the neighborhood of the damaged areas before considering the employment of flaps or tissues from the vicinity of the defect or from distant areas of the body. In cases of injury the procedure of choice should always be to repair the defect promptly, bearing in mind that, wherever possible, an immediate one-stage reconstruction offers the best chance of successful restoration from both the functional and the cosmetic point of view.

With these established principles as guides, I offer a case report that illustrates the satisfactory employment of an immediate one-stage repair of extensive damage to the central third of the face. Actually a grafting of avulsed tissues was involved, for devitalized flaps torn from their bony attachments and practically devoid of blood supply constituted a composite graft of bone, cartilage and soft tissue. In my opinion the rarity of this type of injury warrants publication of the case.

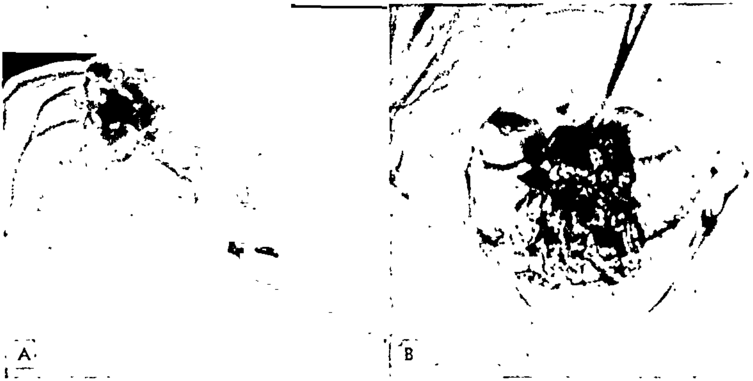

Fig. 1.—*A*, appearance of patient one hour after accident, showing avulsion of central third of face. *B*, closeup of injured area revealing avulsion of upper lip, columella, nasal flap, including nasal bones, and nasal septum. Also present were extensive lacerations of both cheeks from the region of the zygoma to the nasolabial fold.

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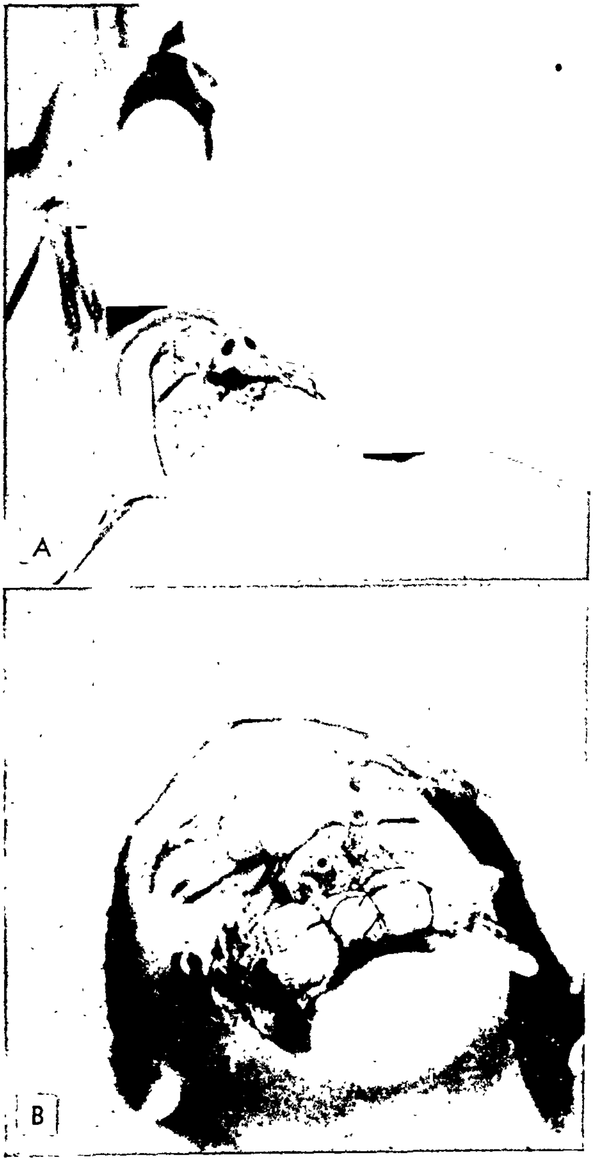

Fig. 2.—*A*, reconstruction attempted two hours after accident. Entire pedicle débrided and fitted into original defect. *B*, end of two-hour operative procedure, showing intranasal catheters and bolster type dressing on upper lip.

## REPORT OF CASE

On Jan. 17, 1952, G. A., a white woman aged 18 was injured in an automobile accident at 11 p.m. She stated that she had been unconscious for a few minutes after the crash, but remembered sitting in the front seat of the car and being thrown forward and pinned to the windshield. She recalled that her face was bleeding badly and that someone covered it, put her on a stretcher and brought her to the hospital.

On admission the patient was conscious and in a state of moderate shock with all its clinical manifestations. She was alert enough to try to answer simple questions but had difficulty in enunciating words and considerable pain with any movement of the head. On first appearance the central third of the face appeared to be an unrecognizable mass of mangled soft tissues that had been avulsed from their bony attachments. There was a void where the upper lip and the nose should have been located, and a narrow pedicle (attached only by skin to the root of the nose) contained the middle third of the upper lip, the philtrum, the columella, one-half of the nasal septum, with portions of the inferior turbinates, and practically the entire nose. In the deeper portions of this wound were located the upper half of the nasal septum and portions of the superior and middle turbinates of each side. The base of the face wound contained two clot-covered apertures that represented the nasal openings, through which one could see the nasopharynx. Many fragments of septal cartilage were scattered in the wound, and the perpendicular plate of the ethmoid was visualized in the depth of the central cavity. The ethmoids did not appear to be fractured. After cleansing, irrigation and draping of the face more careful examination was possible. With local infiltration procaine anesthesia, supplemented by small doses of Penthothal, the following injuries were noted:

1. Compound comminuted fractures of the nasal bones.
2. Avulsion of the central third of the upper lip, with exposure of the right maxilla.
3. Avulsion of the nose from the columella to the nasal bridge.
4. Multiple fractures of the nasal septum, with displacement of the upper half into the attached pedicle.
5. Multiple lacerations of both cheeks, eyebrows and the region of the left knee.

After consideration of the patient's satisfactory general condition, it was decided to attempt an immediate one-stage grafting and reconstruction of the avulsed tissues. Prime attention was given to the establishment of a normal nasal passageway, which, from the functional point of view, seemed the most difficult chore. Consideration of the reconstruction of a normal nose was also kept in mind during the operative procedure.

*Operation.*—Attention was first directed to control of the bleeding in the mangled avulsed pedicle, followed by debridement of glass, dirt and devitalized skin and mucous membrane. Two fine wire sutures were used to reapproximate the torn nasal septum and relocate it in its central position. Many fine interrupted sutures were required to restore the continuity of the turbinates on each side and the mucous membrane covering of the cartilaginous septum. After this, two medium-sized rubber catheters were inserted in the nares and directed posteriorly into the nasopharynx. These tubes acted both as splints and as nasal airways. Inspection of the distal portion of the pedicle showed it to contain the columella, the philtrum and the central third of the upper lip; all of these tissues were pale, and little bleeding was present. Gentle cleansing and a slow reconstruction of these parts followed, plain fine catgut sutures being used for the muscle layers and fine black silk sutures for accurate approximation of the edges of mucous membrane within the mouth and the edges of skin on the face. Next, the many lacerations of cheeks, lips and eyebrows were closed with fine interrupted silk, and a bolster type of pressure dressing was fixed by through-and-through suturing of the labial region. Finally the flattened nasal bridge was elevated, and petrolatum gauze dressings were applied over all wounds.

*Postoperative Course.*—On January 18, the morning after the operation, the patient appeared in good condition. Parenteral fluids and sedation had been administered and antibiotic therapy begun. Tetanus antitoxin was given and saline compresses were ordered to keep the soft tissues moist and free of serum and blood clots. The nasal catheters were frequently irrigated to keep the nasal airways clear, since these were kept in their original position for six days. It was hoped that these tubes would stabilize the nasal septum while it was healing. Postoperative roentgenograms were taken (Fig. 3*A*).

Six days after the operation, with the patient under general anesthesia, the original dressings were changed and the rubber catheters and most of the skin sutures were removed. The grafted pedicle showed fair color, and in most areas healing was satisfactory.

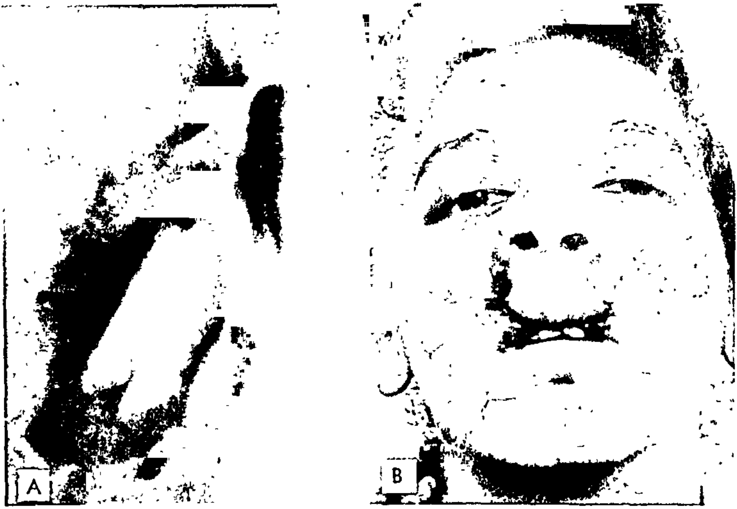

Fig. 3.—A, roentgen film revealing multiple fractures of the nasal bones. Wire sutures in place, uniting torn nasal septum. *B*, appearance eighteen days after injury. Patient discharged from hospital with satisfactory airways and granulating wounds of nasolabial folds.

neous tissues, cartilage and bone involved in a pedicle containing the upper lip and nose. Nine months after the original injury the patient was operated on for removal of conspicuous facial scars. The final result was satisfactory from both the functional and the cosmetic point of view. It was considered that the surgeon's responsibility had been satisfactorily discharged.

### ZUSAMMENFASSUNG

Es wird über einen Fall von sofortiger einzeitiger Reparatur einer schweren Gesichtsverletzung berichtet. Die Operation dauerte drei Stunden, und es wurde ein Transplantationslappen aus Haut, Unterhautzellgewebe, Knorpel und Knochen benützt, dessen Stiel die Oberlippe und die Nase enthielt. Neun Monate nach dem Unfall wurde der Kranke zwecks Entfernung auffälliger Gesichtsnarben operiert. Das Endergebnis war sowohl vom funktionellen als auch vom kosmetischen Standpunkt aus zufriedenstellend. Es lässt sich sagen, dass der Chirurg seine Pflicht in verantwortlicher und befriedigender Weise erfüllt hat.

### RIASSUNTO

Una grave lesione traumatica della faccia fu riparata chirurgicamente in un tempo unico, con un intervento della durata di 3 ore. Si usò un trapianto cutaneo complesso, con sottocutaneo, cartilagine e osso. Dopo 9 mesi si dovette procedere alla plastica delle cicatrici deturpanti, ma il risultato definitivo fu soddisfacente dal punto di vista cometico e funzionale.

### RESUMEN

Se comunica un caso mostrando una reconstrucción inmediata en un tiempo de una lesión facial grave. La reconstrucción requirió tres horas, utilizando uninjerto compuesto de piel, tejido celular, cartílago y hueso, aplicado en un pedículo conteniendo la nariz labio superior. Nueve meses después de la lesión, se operó al paciente a fin de quitar cicatrices faciales. El resultado final fué satisfactorio desde los puntos de vista cosmético y funcional. Se consideró que la responsabilidada del cirujano había sido descargada satisfactoriamente.

### SUMARIO

O autor comunica um caso em que realizou uma reconstrução imediata em um tempo de grave lesão da face. O reparo foi feito à custa de um enxerto de pele, tecido subcutâneo, cartilagem e osso, incluidos em um pedículo contendo lábio superior e nariz. Nove meses após a lesão inicial, foi removida a cicatriz facial. O resultado final foi satisfatório sob o ponto de vista funcional e cosmético.

### RÉSUMÉ

L'auteur rapporte un cas montrant une reconstitution en anatomique un temps d'une blessure grave de la face. La durée opératoire fut de 3 heures. On a utilisé une greffe composée de peau, de tissu souscutané, de cartilage et d'os inclus dans la peau. Neuf mois plus tard on excisa les cicatrices. Le résultat final donna satisfaction, tant au point de vue fonctionnel qu'au point de vue esthétique, à telle enseigne que la responsabilité du chirurgien fut complétement dégagée.

# Combined Abdominal and Right Thoracic Approach to Lesions of the Middle and Upper Thirds of the Esophagus, and its Immediate Results

SHIGETSUGU KATSURA, M.D., F.I.C.S., AND YOSHINOBU ISHIKAWA

SENDI, JAPAN

THE prevailing surgical approach to esophageal carcinoma consists of bringing up the stomach from the left side of the thorax through a left thoracotomy.

Lewis[1] (1946), Mcmanus[2] (1948), Kent[3] (1950) and others have reported a method of bringing the stomach into the right side of the thorax. Sweet and Garlock,[3] (1950) who are authorities in this field in the United States, are not in favor of approaching the esophageal lesion through a right thoracotomy.

According to our experience, left thoracotomy for carcinoma of the upper and middle portions of the esophagus carcinoma is inconvenient, because separation of the tumor behind the aortic arch is hard to perform.

Our operative procedure is as follows: 1. *Abdominal part*: After laparotomy, the stomach is freed. Then the abdominal wall is closed. 2. *Thoracic part*: Left thoracotomy is done for carcinoma of the lower part of the esophagus and for cardia carcinoma, right thoracotomy carcinoma of the upper and middle parts of the esophagus. Then the tumor is excised and gastroesophageal anastomosis done. In both approaches the stomach is brought up through the hiatus of the diaphragm without division of the diaphragm. The abdominal and the thoracic parts of this operation are done in one stage.

As is shown in Table 1, 38 carcinomas of the esophagus and cardia have been operated on through the chest from April 1950 to September 1952, with 3 deaths (7.9 per cent). In 16 cases of carcinoma of the upper and middle parts of the esophagus the stomach was brought through the right side of the chest. Of these, gastroesophageal anastomosis in the right side of the chest was done in 10. There was 1 operative death; the patient had a perforation of the esophageal carcinoma in the right side of the chest. Two days later empyema occurred in the chest cavity. An emergency operation was done, but the patient died on the tenth postoperative day owing to deterioration of empyema thoracis. In 6 cases esophagogastrostomy was performed on the right side of the neck bringing the stomach from the right side of the chest. One of the 6 patients died of the operation; empyema thoracis occurred as a result of necrosis of the stomach close to the anastomosis. Death occurred on the fourteenth postoperative day.

TABLE 1.—*Immediate Results of Operation (April 1950 to October 1952)*

| *Method of Operation* | *No. of Cases* | *Operative Deaths* |
|---|---|---|
| Gastroesophageal anastomosis in left side of thorax.......... | 15 | 0 |
| Gastroesophageal anastomosis in right side of thorax...... ... | 10 | 1 |
| Gastroesophageal anastomosis at neck bringing stomach from right side of thorax.... | 6 | 1 |
| Gastroesophageal anastomosis at neck bringing stomach anterior to thorax.............. | 7 | 1 |
| Total .................................... | 38 | 3(7.9%) |

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Submitted for publication Aug. 12, 1953.

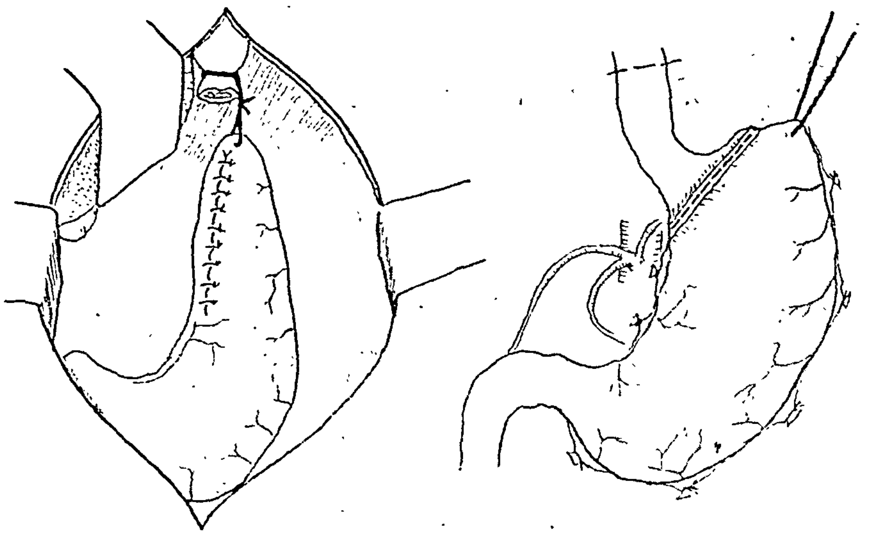

Fig. 1.—Abdominal part of operative procedure.

jured if meticulous care is observed. With this procedure we have always been able to achieve our purpose. A string is sutured to the highest portion of the stomach and tied with the string attached to the esophagus (Fig. 1).

This procedure has been adopted for total esophagectomy, but when an esophagogastrostomy is done in the pleural cavity the omentum is incised to free the stomach for the length expected to be necessary for anastomosis. The stomach is cut at the cardia with the von Petz clamp to make a gastric tube, as shown in Fig. 2 *1*. This tube is tied with the esophagus. The abdominal wall is closed. The abdominal part of the operation is then completed.

The right fifth or sixth rib is cut as far as the posterior axillary line, and one rib above or below the resected rib is cut at the posterior part of the bone. The pleural cavity is entered at the bed of the excised rib and is widely opened. As the procedure is done under atmospheric pressure, the lung collapses after a short while. After the lung has been retracted with a malleable retractor, the tumor is examined carefully.

In total esophagectomy or when the anastomosis is performed above the azygous vein, it is necessary to sever the vein between ligatures. The esophagus is freed from above and below the lesion, and the tumor is removed *en mas*. In performing gastroesophageal anastomosis in the chest, the esophagus is freed 5 cm. above the infiltration of the lesion, or as much as is necessary. As the blood vessels to the esophagus appear like strings, they are ligated.

In extirpating the tumor, the infiltrative lesion is resected as far as possible even when contralateral pneumothorax is expected. However, when the aorta and the trachea are infiltrated, a palliative operation is done. The operation is never limited to exploration. When the anastomosis is done in the thorax, an ordinary intestinal clamp is applied 5 cm. above the tumor, and the esophagus is severed 2 cm. from the intestinal clamp. A clamp is also applied to the end of the stomach, with ample gastric wall. The posterior layer is made by using four or five interrupted sutures through the whole layer of the esophagus and the stomach. The anterior anastomosis is carried out by using several interrupted sutures through and through the esophagus and the stomach. Both clamps are then removed. A gastric catheter (size Fr. 6) is inserted through the nose and left in the stomach. The gastric serosa and the muscular coat of the esophagus are sutured together with Lembert's seromuscular stitches over the anastomosed part, as is done for the anastomosis of gastroenterostomy. The gastric serosa and the mediastinal pleura are sutured with several interrupted sutures (Fig. 2).

In total esophagectomy the esophagus is freed superiorly, with ample margin from the tumor. The esophagus is tied above the tumor and the esophagus is cut for removal. The highest portion of the stomach and the remaining stump of the esophagus are tied together. An incision is made low in the right side of the neck, medial to the sternocleidomastoid muscle. The blood vessels are retracted laterally. The stomach is brought out from the incision with the esophagus. After enough of the stomach has been brought out to perform the anastomosis, the circumference of the stomach is sutured to the neck muscle. Penicillin is then sprayed into the pleural cavity. The lung is completely inflated again. A T figure drain is inserted in the pleural cavity, and the chest wall is closed.

Esophagogastrostomy is done at the neck, with use of interrupted sutures in two layers. The stomach is not fixed at the hiatus of the diaphragm either when total esophagectomy is performed or when gastroesophageal anastomosis is performed in the thorax.

*Postoperative Care and Condition.*—The time required for the operation is about two hours. The blood pressure, pulse rate, respiratory rate and blood gas content do not change much during the operation.

No special management is necessary in these cases. The usual measures described in the literature — care of postoperative fluid balance, blood transfusion, precautions to prevent pulmonary complications —are carried out. Fluid is given through the gastric catheter from the fourth postoperative day, and soft foods from the seventh. The postoperative course is generally smooth, except when complications arise.

The postoperative function of various organs is examined. Liver function returns within three weeks to its preoperative condition. Pulmonary and cardiac function and the function of the stomach (digestion and absorption) after one month are shown in Tables 4 and 5. These functions were measured in those patients

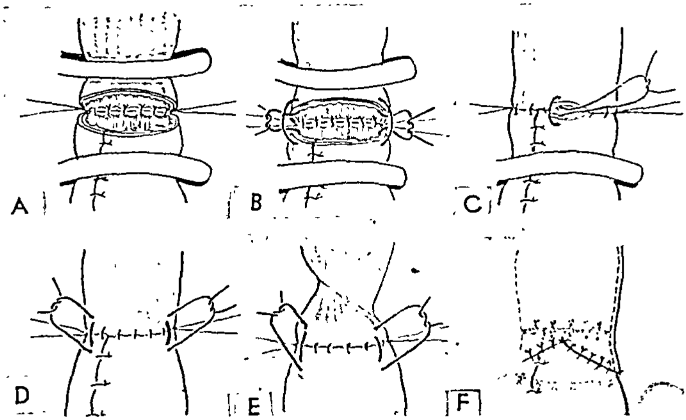

Fig. 2.—Method of making a gastric tube and gastroe

trachea, the infiltration of the primary tumor is left behind and a new alimentary canal constructed. We do not suspend the procedure in the middle of the operation. In these cases, we expect a recurrence of the lesion in a short time. Generally speaking, when the lesion is in an advanced stage, stenosis of the esophagus is severe. By the operation the life of the patient is prolonged.

It is sometimes said that carcinoma is a disease in the hands of Fate. It has been our occasional experience that the outcome is entirely different from what was expected at the operation. We have a patient who was operated on for esophageal carcinoma with a part of the tumor left at the aortic arch (microscopically diagnosed as basal cell carcinoma), but the patient is still enjoying his life eight months after the operation. We think that this case supports our idea for palliative operation. Several patients with tumors left in the thorax died two or three months after the operation. In any way, the patient receives great benefit from the operation.

We believe that immediate results are as good as those reported by others. We have examined the functions of the heart and liver and the digestive and absorptive functions of the intestine tract, and they have been examined respectively. The results are given.

The functions of the aforementioned organs are not disturbed so much as to interfere with daily activity. The results are compared with those in cases of carcinoma of the lower part of the esophagus in which gastroesophageal anastomosis was performed in the left side of the chest. In the latter cases the stomach is not mobilized very much. It does not seem to disturb the various functions of the organs to any significant extent. For this reason, we advocate operations from the right side of the chest for carcinoma of the upper and middle parts of the esophagus.

### ZUSAMMENFASSUNG

Es werden die Ergebnisse der Behandlung von 38 Fällen von intrathorakalem Speiseröhrenkrebs (7,9% Sterblichkeit) beschrieben. Die beim Zugang von der rechten Seite her angewandte Operationstechnik und das postoperative Verhalten der wichtigen Organe werden erörtert.

### RÉSUMÈ

Les auteurs rapportent 38 cas de cancer de l'oesophage av ec une mortalité de 7.9%. Ils emploient l'ouverture du thorax droit.

### RESUMEN

Se describen los resultados en 38 casos de carcinoma del esófago en el tórax (grado de mortalidad 7.9 por ciento). Se discuten la ténica operatoria usada para abordar las funciones post operatorias de los órganos importantes.

### SUMÁRIO

São apresentados pelos autôres os resultados obtidos em 38 casos de carcinôma esofagiano (porção toracica), com uma mortalidade de 7,9%. A técnica operatória utilisada e as funções posoperatórias do importante orgão são apreciados nêsse trabalho.

### RIASSUNTO

Vengono riferiti i risultati ottenuti in 38 interventi per carcinoma dell'esofago toracico (mortalità 7,9%). Vengono discusse la tecnica operatoria usata per aggredire la lesione da destra e le funzioni dei principali organi nel periodo post-operatorio.

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# Anomalous Conditions Affecting the Urinary Tract

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THE genital system, so far as nature is concerned, is the most vital system of organs, since it is the instrument of propagation of the species. Yet anomalies of the urogenital organs are considered to constitute 35 to 40 per cent of all maldevelopments of the body. The embryonic development of the genital system and that of the urinary system are intimately related. It is acknowledged that major anomalies of the genitalia are associated with anomalies of the upper portion of the urinary tract in a high percentage of instances. Anomalous conditions of the urinary tract are usually obstructive or are capable of producing stasis, which almost invariably favors the development of infection. It is not unusual for the symptoms of infection to call initial attention to the presence of an anomaly.

No attempt will be made to enumerate all the anomalous conditions of the lower part of the urinary tract. Instead, two conditions will be presented for consideration; the first is congenital stricture of the ureter, and the second is meningocele and its influence on the urinary tract.

Although many theories have been advanced as to the underlying factors producing such anomalies, statistics indicating the predominance of certain factors producing anomalies now satisfactorily explain the occurrence of anomalies in every instance. It is considered that more than 10 per cent of all human beings are born with some type of urogenital anomaly.

Congenital ureteral stricture is not an uncommon urologic occurrence. Stricture of the ureter productive of disease of the upper part of the urinary tract, was not considered a clinical entity until Hunner, in 1911, first described this condition in adults. Campbell, in 1939, stated that the condition was one of the most common of all anomalies in children with chronic pyuria. As a result of these presentations, the attention of the profession has been more acutely focused upon the incidence of this condition.

Congenital stricture usually occurs at the points of physiologic constriction of the ureter; at the ureteropelvic juncture, at the position of the iliac vessels, and at the ureterovesical juncture. It is in the last mentioned site that the condition occurs most frequently. Attention is directed to the strictures occurring at this site. In some of the reported series, strictures at the ureterovesical juncture have been shown to occur in more than 50 per cent of cases. The condition occurs with equal frequency in the two sexes and may be unilateral or bilateral.

*Symptoms.*—Congenital ureteral stricture does not necessarily present a classical symptomatic picture; when symptoms do occur, however, they fall within a more or less typical pattern. The most frequent symptoms are persistent or recurrent pyuria and pain. Infection is almost inevitable. With infection, chills and fever are common and not infrequently recurrent. Eradication of the infection is extremely difficult if not impossible in the presence of an obstructive uropathic condition, regardless of its site. Before intelligent therapy can be inaugurated, therefore, it becomes imperative to establish evidence of obstruction. Excreto

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### ZUSAMMENFASSUNG

Es werden zwei ganz verschiedene Anomalien beschrieben, die beide ein Beispiel von Obstruktion der Harnwege mit Infektion, Hydronephrose und herabgesetzter Nierenfunktion abgeben. Diese Zustände finden sich immer im Zusammenhang mit umfangreichen Anomalien der Harnwege oder mit solchen, die den Harnapparat direkt oder indirekt mit einbeziehen.

### RÉSUMÉ

L'auteur décrit deux cas pathologiques les voies urinaires. Il s'agit d'obstruction et d'infection des uretères qui ont provoqué une hydronéphrose avec fonction rénale altérée.

### RESUMEN

Se describen dos padeciementos anómalos. Ambos padecimientos ejemplifican la presencia de padecimiento obstructivo del tracto urinario, infección y producción de hidronefrosis con perturbación de la funcion renal. Factores que síempre se encuentran asociados con padecimientos anómalos extensos del tracto urinario, 6 que lo afectan directa ó indirectamente.

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If you have knowledge, let others light their candles at it.
—*Margaret Fuller*

Knowledge is a treasure, but practice is the key to it.
—*Thomas Fuller*

Excepting for knowledge nothing has any meaning, and to have no meaning is to be non-existent. —*Lord Haldane*

Nothing exists because it is known, but things are known because they exist. —*L. T. Hobhouse*

Knowledge and timber shouldn't be much used till they are seasoned.
—*O. W. Holmes*

If a little knowledge is dangerous, where is the man who has so much as to be out of danger? —*T. H. Huxley*

The seeds of knowledge may be planted in solitude, but must be cultivated in public. —*Johnson*

The world does not require so much to be informed as to be reminded.
——*Hannah More*

I am like a book, with pages that have stuck together for want of use: my mind needs unpacking and the truths stored within must be turned over from time to time, to be ready when occasion demands.—*Seneca*

# Electric Shock to Change Ventricular Fibrillation into Normal Cardiac Rhythm

## Experimental Studies and Clinical Experiences

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CARDIAC arrest has been discussed from various angles, and many experimental studies and clinical experiences have been reported. Ventricular fibrillation has also been studied very thoroughly as one of the important conditions of cardiac arrest.

It has been generally accepted that electric shock is a useful means of stopping ventricular fibrillation; however, the electric shock often changes fibrillation into complete arrest, and it is sometimes difficult to regain normal rhythm.

From our experimental studies we concluded that the heart can always be successfully defibrillated and the rhythm changed directly to the normal heartbeat when a convenient electric current is applied in a fixed direction, as long as the heart had not been damaged irreversibly. This conclusion was confirmed by 2 clinical cases.

*Animal Experiments.*—1. *Method:* An apparatus (Fig. 1) was used for electric shock. *A* indicates an amperemeter for A.C., the capacity of which is 3 amperes. *V* indicates a voltmeter for A.C., which can measure from 0 to 130 volts. *T* indicates a timer, which is used for control of the duration of stimulation. *R* indicates an electrode. These are round plates 1 mm. thick and 7, 5, 3 and 2 cm. in diameter.

Adult mongrel dogs weighing 12 to 15 Kg. were used for the experiment. After intravenous injection of 5 to 8 cc. of pentothal, an intratracheal tube was inserted. Simultaneously with the thoracotomy, artificial respiration was maintained, with the use of pure oxygen, air or nitrogen containing a specific amount of oxygen. The heart was exposed after incision of the pericardium, and experiments with electric shock were performed under various conditions.

2. *Results:* a. *Conditions producing ventricular fibrillation by electric shock.* One electrode was placed on the wall of the right ventricle and another on the left ventricle, and stimulation was made during various periods. The range of electric power and the duration of the stimulation required to produce ventricular fibrillation are shown in Table 1. In this series of experiments, pure oxygen or air was used for respiration. The following results were obtained from this experiment.

1. When a weak electric current, the voltage of which was lower than 25 volts and the amperage weaker than 0.2 ampere, was applied for a short period, namely 0.05 second, fibrillation did not occur; but when it was applied for 0.5 second or a longer period, fibrillation always occurred.

2. When the voltage applied was higher and the current was in the range of 30 to 60 volts, 0.2 to 0.4 ampere was applied during a short period (0.05 second). Fibrillation did not occur, but it occurred when the same current was applied for 0.1 second.

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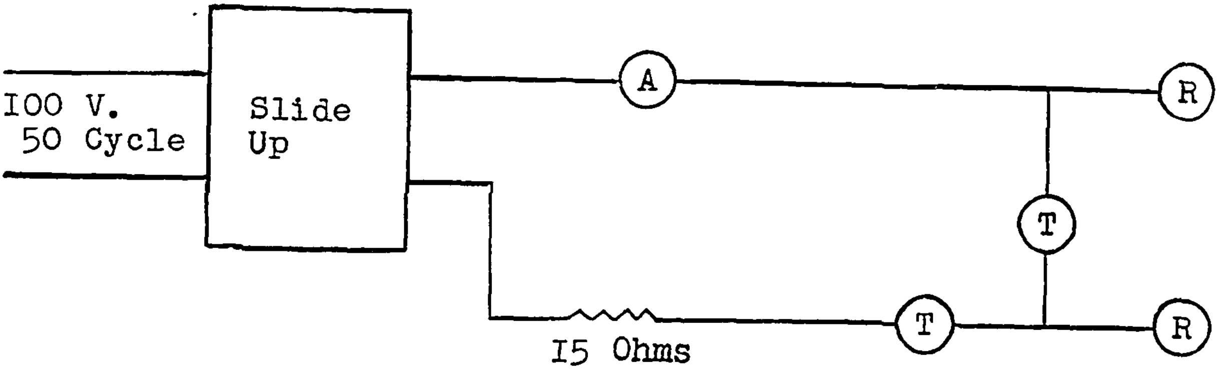

Fig. 1.—Apparatus used for electric shock (see text).

3. When the voltage applied was higher (the current being 70 to 80 volts and the amperage 0.5), and the time period was 0.05 second or a longer period, fibrillation occurred.

4. When a still slightly stronger current (85 to 90 volts and 0.5 to 0.9 amperes) was applied during a longer period (0.5 second or more) fibrillation occurred, but it did not occur if the current was applied during a period shorter than 0.5 second.

5. *When a current of higher voltage* than 95 volts and stronger power than 0.9 ampere was applied, fibrillation did not occur after any period of stimulation.

When one electrode was placed on the apex of the heart and another on the base, and current was passed along the axis of the heart, fibrillation was difficult to produce with either the lower or the higher voltage.

Accordingly, in order to observe constantly ventricular fibrillation by electric shock, under artificial respiration, using pure oxygen or normal air, in cases of normal dogs, the following condition of electrical stimulation is most convenient.

One electrode is placed on the wall of the right and left ventricles. Electric current of 10 to 50 volts and 0.3 ampere or less is applied during 0.5 second or more.

b. *Conditions inhibiting ventricular fibrillation from electric shock:* The most suitable conditions under which one may stop ventricular fibrillation by electric shock have also been studied.

It is very important to note that the period from the occurrence of ventricular fibrillation to the time of electric shock, which is to be described, is one of the most important conditions.

1. *Cases in which electrodes were placed on the right and left ventricular walls.* According to the majority of the studies heretofore reported, electric current was passed through electrodes placed on the right and left ventricular walls for the purpose of defibrillation. Using this method, we obtained the results partially shown in Table 2; i.e., in some cases, when fibrillation stopped, the heartbeat stopped simultaneously. In other cases the fibrillation stopped while the heartbeat regained its normal rhythm.

Generally, in order to stop fibrillation by stimulation in the aforementioned method, the condition of cardiac standstill is usually expected at first. Thereafter it is necessary to regain the normal heartbeat by cardiac massage, etc. When once cardiac arrest has occurred, it is not infrequent to observe fibrillation after cardiac massage.

2. *Cases in which electrodes were placed on the apex and the base of the heart and the current was passed through the longitudinal axis.* When one electrode was placed on the apex and the other on the base of the heart, and current was passed through the longitudinal axis, constant results were obtained (Table 3).

In spite of the duration of stimulation, defibrillation could not be induced by electric current of 85 volts and 0.7 ampere or less.

By a current of 90 to 100 volts and 0.9

TABLE 1.—*Electric Stimulations which produce Ventricular Fibrillation*

| *Voltage* | *Amperage* | *Second* 0.05 | 0.1 | 0.5 |
|---|---|---|---|---|
| 10 | less | − | − | + |
| 15 | than | − | − | + |
| 20 | 0.2 | − | − | + |
| 25 | | − | − | + |
| 30 | 0.2 | − | + | + |
| 35 | 0.2 | − | + | + |
| 40 | 0.3 | − | + | + |
| 45 | 0.3 | − | + | + |
| 50 | 0.3 | − | + | + |
| 55 | 0.4 | − | + | + |
| 60 | 0.4 | − | + | + |
| 65 | 0.4 | − | + | + |
| 70 | 0.5 | + | + | + |
| 75 | 0.5 | + | + | + |
| 80 | 0.5 | + | + | + |
| 85 | 0.7 | − | − | + |
| 90 | 0.9 | − | − | + |
| 95 | 0.9 | − | − | − |
| 100 | 0.9 | − | − | − |
| 105 | 1.0 | − | − | − |
| 110 | 1.2 | − | − | − |
| 115 | 1.5 | − | − | − |
| 120 | 1.6 | − | − | − |
| 125 | 1.7 | − | − | − |
| 130 | 1.8 | − | − | − |

+: Possible to produce ventricular fibrillation.

ampere, when the stimulation was continued for a short period (0.05 second), fibrillation stopped and the heartbeat simultaneously regained its normal rhythm.

With a stronger current such as (110 to 130 volts and 1.2 to 1.8 amperes), when stimulation was continued for 0.05 to 0.1 second, fibrillation invariably stopped and the heart regained its normal rhythm immediately.

With a stronger current, if it was continued during more than 0.5 second, it was impossible to stop fibrillation.

*Longitudinal stimulation:* Direction of the current in the longitudinal axis of the heart must be discussed more exactly.

One electrode was constantly kept on the apex, while the other was moved gradually from the starting point of the pulmonary artery to the right ventricle. When stimulation was continued, in searching for a point which would act as a focus to stop fibrillation and to restore the heart to its normal rate, it became clear that the area from the crotch formed by the superior vena cava and the right atrium to a portion along the terminal sulcus was the most suitable site for defibrillation and recovery of the normal heartbeat. When this point was observed from the surface of the heart, it might be near a point called Keith-Flack's node or sinus node. This point is called *A* point for convenience (*Fig.* 2).

One electrode was kept on the *A* point constantly, and the other was moved gradually from the left to the right ventricle in order to stimulate the heart. When the latter reached the apex of the heart, the normal heartbeat was regained in most cases.

Defibrillation could also be performed when one electrode was kept constantly on the apex, just posterior to its most caudal point, and the other placed on the right atrium, and the normal heartbeat could be regained. However, it was slightly more difficult than in cases in which the other electrode was placed on the *A* point.

This direction in the longitudinal axis may be assumed to have some relation to the conducting system of cardiac impulse, but there is no positive proof.

From the results of the aforedescribed experiments, the following conclusions can be drawn:

TABLE 2.—*Result of Stimulation when Electrodes were Placed on the Right and Left Ventricular Walls*

| *Voltage* | *Amperage* | *Second* | *Number of Times Stimulated* | *Results* |
|---|---|---|---|---|
| 90 | 0.9 | 0.05 | 7 | Fibrillation-standstill |
| 95 | 0.9 | 0.05 | 5 | Fibrillation-flutter |
| 100 | 0.9 | 0.05 | 2-3 | Fibrillation-fibrillation |
| 110 | 1.2 | 0.05 | 2-3 | Fibrillation-fibrillation |
| 120 | 1.6 | 0.05 | 2 | Fibrillation-fibrillation |
| 120 | 1.6 | 0.05 | 5 | Fibrillation-normal heartbeat |
| 120 | 1.6 | 0.05 | 6 | Fibrillation-standstill |
| 130 | 1.8 | 0.05 | 3 | Fibrillation-standstill |
| 130 | 1.8 | 0.05 | 3 | Fibrillation-normal heartbeat |

TABLE 3.—*Defibrillation when Current was Passed Through the Longitudinal Axis of the Heart*

| | | *Seconds* | | |
|---|---|---|---|---|
| *Voltage* | *Amperage* | *0.05* | *0.1* | *0.5* |
| 10 | | — | — | — |
| 15 | less | — | — | — |
| 20 | than | — | — | — |
| 25 | 0.2 | — | — | — |
| 30 | 0.2 | — | — | — |
| 35 | 0.2 | — | — | — |
| 40 | 0.3 | — | — | — |
| 45 | 0.3 | — | — | — |
| 50 | 0.3 | — | — | — |
| 55 | 0.4 | — | — | — |
| 60 | 0.4 | — | — | — |
| 65 | 0.4 | — | — | — |
| 70 | 0.5 | — | — | — |
| 75 | 0.5 | — | — | — |
| 80 | 0.5 | — | — | — |
| 85 | 0.7 | — | — | — |
| 90 | 0.9 | + | — | — |
| 95 | 0.9 | + | — | — |
| 100 | 0.9 | + | — | — |
| 105 | 1.0 | + | — | — |
| 110 | 1.2 | + | + | — |
| 115 | 1.5 | + | + | — |
| 120 | 1.6 | + | + | — |
| 125 | 1.7 | + | + | — |
| 130 | 1.8 | + | + | — |

+: Successfully defibrillated.

In stopping fibrillation induced by electric shock, it is not wise to stimulate with two electrodes, placed on the right and left ventricular walls; because if fibrillation can be stopped, the heartbeat will often stop too, and it will not always be possible to regain the normal heartbeat immediately.

On the contrary, when stimulation is applied in the longitudinal axis of the heart, with one electrode on the apex, just posterior to its most caudal point, and the other on a portion from the crotch formed by the juncture of the superior vena cava and the right atrium to the terminal sulcus, not only is defibrillation constantly successful, but the normal heartbeat is resumed at once.

In this case, a strong current of 100 to 130 volts and 0.9 to 1.8 amperes must be applied during a short period (0.05 second).

c. *Time limit for successful defibrillation:* The time limit for successful defibrillation by electric shock without cardiac massage is 90 to 105 seconds. If fibrillation continues beyond this time limit, it is necessary to perform cardiac massage (any method). When fibrillation lasts longer, fine fibrillation will gradually change to rough fibrillation, and the heart will become cyanotic. In this condition electric shock is ineffective for defibrillation. If cardiac massage is begun during this period, fibrillation becomes finer and stronger again, and the color of the heart turns to bright red. In such a case, when a suitable current is passed through the longitudinal axis, fibrillation immediately disappears and the normal heartbeat is regained.

When fibrillation lasted more than three minutes and thirty seconds-four minutes without cardiac massage—defibrillation was not obtained even by cardiac massage and electric shock; i.e., if fibrillation lasts longer than this, an irreversible change will occur.

d. *Occurrence of ventricular fibrillation and defibrillation under hypoxic conditions:* Since anoxia is proposed as an important cause of ventricular fibrillation, some studies were performed in this area.

Occurrence of ventricular fibrillation under conditions of apnea:

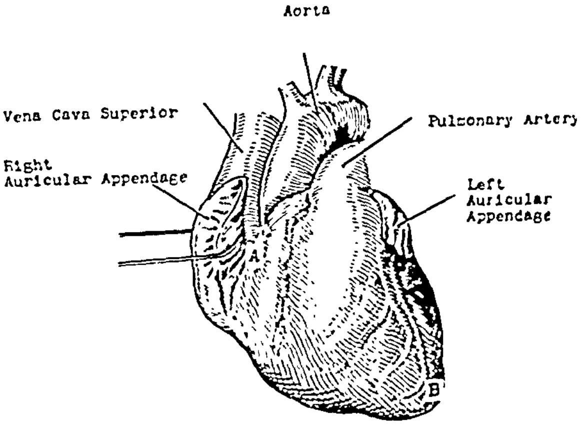

Fig. 2.—Application of electrodes (small size, 110-130 volts alternating current, 0.9-1.8 amp.) 0.05 seconds of stimulation in the longitudinal axis. Electrode *A* between vena cava and right auricle; electrode *B* at apex, posterior surface.

TABLE 4.—*Oxygen and Carbon Dioxide Content of Blood in Respiratory Arrest*

| *Case* | *Blood Levels During Normal Respiration* | | *Duration of Respiratory Arrest* | *Blood Levels Prior to Electric Shock* | | *Blood Levels after Electric Shock* | | *Effect of Electric Shock* |
|---|---|---|---|---|---|---|---|---|
| | $Co_2$ | $O_2$ | | $Co_2$ | $O_2$ | $Co_2$ | $O_2$ | |
| 1 | 40.05 | 20.39 | 6 min. & 50 sec. | 46.91 | 14.15 | 46.21 | 12.38 | Complete Recovery |
| 2 | 28.67 | 18.95 | 8 min. | 34.93 | 4.37 | 11.47 | 14.80 | Complete Recovery |
| 3 | 33.71 | 11.52 | 11 min. | 36.12 | 1.50 | 38.41 | 9.65 | Recovered but finally died |
| 4 | 32.68 | 14.66 | 15 min. | 38.12 | 0.97 | 34.12 | 8.21 | Died |

During intratracheal anesthesia, bilateral thoracotomies were performed and artificial respiration suddenly discontinued; thereupon the lungs collapsed and respiration could not be maintained. In 6 out of 7 cases cardiac arrest occurred ten minutes after the cessation of artificial respiration. Immediately after this condition, if artificial respiration resumed and in addition cardiac massage was instituted, ventricular fibrillation always occurred after two or three minutes.

When electric shock was applied in the longitudinal axis of the heart, a suitable current being used against the fibrillation aforementioned, fibrillation stopped immediately and the normal heartbeat was regained.

In 1 of 7 cases ventricular fibrillation occurred directly only on the cessation of artificial respiration. Cardiac massage and stimulation of suitable current in the longitudinal axis were also successfully done.

In any case, the time between the cessation of artificial respiration and the beginning of cardiac massage, must be limited to eight minutes. When it was not, even if defibrillation was successfully done, the dogs finally died.

During the first half of this eight-minute period the pulsation of the peripheral arteries could be palpated, but during the last half the pulse disappeared. Accordingly, four minutes after the disappearance of the peripheral arterial pulsation, it is impossible to defibrillate the heart successfully by cardiac massage and electric shock.

In cases in which fibrillation lasted longer than eight minutes after cessation of artificial respiration, the oxygen content of the arterial blood was markedly lower just prior to electric shock; and when defibrillation was successful, it did not regain the normal level before operation. Therefore, death ultimately occurred (Table 4).

Occurrence of ventricular fibrillation and its defibrillation under hypoxic respiration:

In the presence of hypoxia, ventricular fibrillation is supposed to occur easily. We, therefore, studied the production of ventricular fibrillation using nitrogen containing oxygen in the proportions of 20, 10 and 3 per cent. The electrodes were placed on the right and left ventricular walls, and various currents were applied.

The results obtained are illustrated in Figure 3. The wide line indicates the electric current that produced fibrillation. According to Figure 3, fibrillation is more easily produced in cases of hypoxic respiration; however, this is not remarkable.

Defibrillation under hypoxia was also studied.

In cases of nitrogen containing 20 per cent oxygen, which is similar to normal air, and also in cases of pure [illegible] piration, the [illegible] cat.

surface. Electric current (120 volts, 1.5 amperes) was passed for 0.05 second. Three electric shocks were applied with no effect, as was expected from our experimental studies. After the shock, cyanosis appeared on the surface of the heart. Then the massage was continued until the heart became red again. Several minutes later the second shock was applied. One electrode was placed at *A* and the other on the apex, just posterior to its most caudal point.

The same current was used on two occasions. Immediately after the heart was shocked, the ventricular fibrillation changed to the normal rate, as had been expected from our animal experiments. It was 10:57 a.m. Thirty-one minutes after the beginning of the ventricular fibrillation, 0.5 cc. of 1:1,000 epinephrine and 1 cc. of strophantin were injected to strengthen the contraction. The blood pressure rose to 110 mm. of mercury several minutes later. The pericardium and the chest wall were closed, and the operation was finished at 11:40 a.m.

The patient became conscious when the chest wall was closed. The postoperative course was uneventful. At the time of writing he can walk without palpitation and is waiting for discharge. No neurologic disturbance remains.

CASE 2.—A 30-year-old man was admitted to the hospital on Feb. 5, 1954. He was seized with rheumatic arthritis when he was 11 years old. Since then a diagnosis of cardiac valvular disease had been made. Palpitation, dyspnea on exertion and arrythmia were the chief complaints. A thoracic roentgenogram showed cardiac enlargement on both sides, especially the left. A systolic murmur was heard at the apex. An electrocardiogram revealed evidence of left ventricular "strain" and myocardial damage. A diagnosis of aortic stenosis was made.

Operation was performed on February 11, starting at 12 noon. The chest was opened with oxygen respiration through an endotracheal tube and local anesthesia.

The left ventricle was remarkably enlarged. A course thrill was palpated at the ascending aorta. The pericardium was opened five minutes after 5 cc. of 4 per cent procaine hydrochloride had been injected into the percardial sac. The heart was held by the left hand from the posterior surface. Two fixing mattress sutures were placed at the apex. At that time the heart stopped beating suddenly. Heart massage was given immediately. After several minutes ventricular fibrillation was noted. Fibrillation became finer, and the heart surface became bright red about twenty minutes later. The first electric shock (120 volts, 1.5 amperes, 0.05 second) was tried, with one electrode on the anterior surface and the other on the posterior surface of the heart.

Ventricular fibrillation did not stop after several electric shocks, and the heart became cyanotic. Massage was continued, and after about twenty minutes the organ became bright red again. The second electric shock was then tried. One electrode was placed at *A* and the other at the apex. Electric current (120 volts, 1.5 amperes, 0.05 second) was applied. Suddenly the normal heartbeat was resumed. It was forty-one minutes since the onset of cardiac arrest. Because of this unexpected accident, the aortic valvulotomy was abandoned. The chest was closed. The patient became conscious and was transferred to the recovery room at 2:25 p.m. At about 6 p.m. his condition suddenly changed. The pulse became weaker, and the respiration became very superficial. Complete arrest finally occurred. Despite all efforts of massage and electrical stimulation, the heart did not beat again.

Although we could not help this patient, we were successful in changing ventricular fibrillation to a normal beat.

## COMMENT

Electric shock has often been employed to change fibrillation into complete arrest of cardiac action, after which cardiac massage and some other methods have been tried to regain the normal beat. The heart might accidentally regain its normal beat, but fibrillation would appear again in such circumstances.

Using dogs, we obtained experimentally the following results:

1. When a suitable electric current was applied in the longitudinal axis of the heart during a suitable period, the normal heartbeat was regained immediately after defibrillation, without changing into complete cardiac arrest.

Suitable current in these cases is 100 to 130 volts and 0.9 to 1.8 amperes in the dog, and the duration of stimulation is 0.05 second. Stimulation in the longitudinal axis of the heart indicates a method of stimulation from one electrode placed on the posterior surface of the left ventricle just above the apex and another electrode placed on the crotch formed by the superior vena cava and the right auricle to the terminal sulcus.

2. The oxygen supply to the cardiac muscle is the most important factor in determining the animal's ability to recover completely from fibrillation.

When respiration is maintained perfectly by pure oxygen or normal air, defibrillation can be performed and the normal heartbeat regained by electric shock only, without massage, within ninety to one hundred seconds after the occurrence of fibrillation.

If fibrillation lasts longer than ninety to one hundred seconds and cardiac massage is begun within four minutes after the occurrence of fibrillation (in order to supply the cardiac muscle with sufficient oxygen), defibrillation can be performed and the normal heartbeat can be regained by electric shock. In cases in which cardiac massage was begun more than four minutes after the occurrence of fibrillation, the dog finally dies even though the heartbeat regains its normal rhythm.

3. Under hypoxic conditions, ventricular fibrillation by electric shock is easy to produce; it is rare, however, to observe fibrillation produced by anoxia only. Fibrillation will also occur when cardiac massage is begun as a treatment for cardiac arrest. Under hypoxic condition, it is very difficult to perform defibrillation.

4. When a normal dog suddenly is put in a condition of pnoea, the dog can be relieved by artificial respiration, cardiac massage and electric shock by a suitable current, which must be instituted within eight minutes. Pulsation of the femoral artery disappears about four minutes later. Therefore, all procedures must be begun within four minutes after the disappearance of pulsation of the femoral artery.

5. Two clinical patients were defibrillated and regained the normal heartbeat successfully immediately after the aforementioned electric shock was applied

In 1 case it was thirty-one minutes and in the other forty-one minutes, after the onset of fibrillation. The second patient, however, died suddenly four hours after complete recovery from ventricular fibrillation.

6. The results obtained by animal experiments were proved applicable clinical cases.

### *ZUSAMMENFASSUNG*

Es hat sich häufig gezeigt, dass durch anwendung des elektrischen Schocks das Flimmern der Herzkammern in einen völligen Herzstillstand umgewandelt wird, und dass man dann durch Herzmassage und andere Methoden versuchen kann, einen normalen Herzschlag wiederherzustellen. Das Herz kann gelegentlich wieder einen normalen Schlag annehmen, das Flimmern jedoch tritt under diesen Umständen von neuem auf.

*Die Verfasser sind mit Experimenten* am Hunde zu folgenden Ergebnissen gekommen::

1. Bei Anwendung eines geeigneten elektrischen Stromes während eines angemessenen Zeitraumes in der Richtung der Längsachse des Herzens liess sich sofort nach der Entflimmerung ein normaler Herzschlag ohne Übergang in völligen Herzstillstand wiedergewinnen.

Der geeignete Strom besteht beim Hunde aus 100 bis 130 Volt und 0,9 bis 1,8 Ampère, die Dauer des Reizes beträgt 0,05 Sekunden. Reizung in der Richtung der Längsachse des Herzens erfolgt, wenn der Strom von einer Elektrode an der Hinterfläche der linken Herzkammer etwas oberhalb der Herzspitze zu einer anderen Elektrode an der von der oberen Hohlvene und dem rechten Vorhof einerseits und dem Sulcus terminalis andrerseits gebildeten Gabelung verläuft.

2. In der Beurteilung der Fähigkeit des Tieres, sich vom Kammerflimmern völlig zu erholen, spielt die Sauerstoffversorgun des Herzmuskels die wichtigste Rolle.

Wird die Atmung durch Zufuhr v reinem Sauerstoff oder gewöhnlicher Luf völlig aufrecht erhalten, so gelingt es, ein Entflimmern und Wiederherstellung eines normalen Herzschlags ausschli

durch elektrischen Schock ohne Massage innerhalb von 90 bis 100 Sekunden nach Auftreten der Flimmerung zu erzielen. Dauert das Flimmern länger als 90 bis 100 Sekunden und setzt die Herzmassage zum Zwecke einer ausreichenden Sauerstoffzufürung zum Herzmuskel innerhalb von vier Minuten nach Beginn des Flimmerns ein, lässt sich eine Beseitigung des Flimmerns und Wiederherstellung eines normalen Herzschlages durch elektrischen Schock erreichen. In Fällen, wo die Herzmassage später als vier Minuten nach Einsetzen des Flimmerns begonnen wird, stirbt das Tier schliesslich selbst wenn der Herzschlag einen normalen Rhythmus wiedergewinnt.

3. Bei Sauerstoffarmut lässt sich Herzkammerflimmern mit Hilfe des elektrischen Schocks leicht hervorrufen; nur selten jedoch lässt es sich durch Sauerstoffmangel allein erzielen. Zum Flimmern kommt es auch gelegentlich der Anwendung der Herzstillstands. Bei Mangel an Sauerstoff ist es sehr schwer, eine Entflimmerung auszufähren.

4. Ein normaler plötzlich in einen Zustand des Atemstillstandes versetzter Hund kann durch künstliche Atmung, Herzmassage und durch elektrischen Schock mit geeignetem Strom, der innerhalb von acht Minuten einsetzen muss, geheilt werden. In diesem Fall verschwindet der Puls der Oberschenkelarterie etwa vier Minuten später. Daher dürfen die Behandlungsmassnahmen nicht über diesen Zeitraum hinaus verzögert werden.

5. Zwei klinische Patienten wurden entflimmert und gewannen einen normalen Herzschlag unmittelbar nach Anwendung des oben erwähnten elektrischen Schocks. Der Erfolg trat in dem einen Falle 31 Minuten und im anderen Falle 41 Minuten nach Einsetzen des Flimmerns ein. Der letztere starb jedoch plötzlich vier Stunden nach völliger Wiederherstellung an den Folgen des Kammerflimmerns.

6. Es hat sich gezeigt, dass die tierexperimentell gewonnenen Ergebnisse sich auch klinisch verwerten lassen.

## RESUMEN

Frecuentemente se ha inducido un choque eléctrico para cambiar la fibrilación cardíaca al estado de paro cardíaco, después del cual el masaje ó algun otro método se ha intentado para obtener nuevamente un latido normal. El corazón puede obtener accidentalmente su latido normal, pero la fibrilación podría reaparecer en tales circunstancias.

Empleando perros, los autores han obtenido experimentalmente los siguientes resultados

1. Cuando se aplica al eje longitudinal del corazón durante un período adecuado una corriente eléctrica adecuada, el latido cardíaco normal puede ser obtenido inmediatamente después de la desfibrilación sin cambiar al estado de paro cardíaco completo.

Una corriente adecuada en estos casos es de 100 a 130 voltios y de 0.9 a 1.8 amperios en el perro; la estimulación es de 0.05 segundos. La estimulación en el eje longitudinal del corazón indica un método de estimulación a partir de un electrodo que es colocado en la cara posterior del ventrículo izquierdo inmediatamente por encima del apex y de otro electrodo que es colocado en la unión de la vena cava superior y la aurícula derecha con el sulcus terminalis.

2. El aporte de oxígeno del músculo cardíaco es el factor más importante en la determinación de la capacidad del animal para recuperarse completamente de la fibrilación.

Cuando se mantiene la respiración perfectamente por oxígeno puro ó aire normal, la desfibrilación puede llevarse a cabo, obteniéndose un latido cardíaco normal, solamente por el choque eléctrico sin masaje dentro de los 90 a 100 segundos siguientes al comienzo de la fibrilación.

Si la fibrilación dura más de 90 a 100 segundos, aun cuando el el masaje cardíaco se empiece dentro de los cuatro minutos después del comienzo de la fibrilación (a fin de proveer al músculo cardíaco de suficiente oxígeno), la desfibrilación puede llevarse a cabo y obtenerse un latido

cardíaco normal por medio de choque eléctrico. En los casos en los cuales el masaje se empieza después de cuatro minutos después de empezada la fibrilación, el perro muere finalmente, aun cuando el latido cardíaco vuelva a presentar su ritmo normal.

3. Bajo condiciones de hipoxia, la fibrilación ventricular es facil de producir por choque eléctrico; sin embargo, es raro observar la fibrilación producida unicamente por la anoxia. La fibrilación ocurre tambien cuando se empieza a dar masaje como tratamiento para el paro cardíaco. Bajo condiciones de hipoxia es muy díficil de efectuar la desfibrilación.

4. Cuando se pone repentinamente en apnea a un perro normal, dicho perro puede ser aliviado por masaje cardíaco, respiración artificial y choque eléctrico con una corriente adecuada, que debe ser instituída dentro de un tiempo de ocho minutos. En este caso, la pulsación de la arteria femoral desaparece unos cuatro minutos después. Por consiguiente, todos los procedimientos deben de empezarse dentro de los cuatro minutos siguientes a la desaparición de la pulsación en la arteria femoral.

5. Dos pacientes clínicos fueron desfibrilados, obteniéndose latído normal inmediatamente después de que se aplicó el choque eléctrico antedicho. En el primer caso fué treinta y un minutos después del comienzo de la fibrilación y en el segundo cuarenta y un minutos después de la misma. El paciente de este último caso murío repentinamente cuatro horas después de haberse recuperado completamente de la fibrilación ventricular.

6. Los resultados obtenidos de las experiencias en animales fueron aplicables a pacientes clínicos.

## RIASSUNTO

Lo shock elettrico è stato, fino ad ora, impiegato per trasformare la fibrillazione ventricolare in arresto cardiaco, dopo di chè il ritmo normale viene ristabilito con massaggio cardiaco o con altri mezzi. Tuttavia è facile che ricompaia la fibrillazione. Sperimentando su cani, gli autori hanno stabilito che 1) quando si applicano correnti opportune e per il tempo sufficiente lungo l'asse longitudinale del cuore si può ottenere la ripresa del ritmo normale subito dopo la defibrillazione, senza passare attraverso la fase di arresto cardiaco. Le correnti usate sono da 100 a 130 Volts e 0,9 fino a 1,8 Ampères per la durata di 0,05 secondi; per stimolazione secondo l'asse longitudinale si intende l'applicazione di un elettrodo sulla faccia posteriore del ventricolo sinistro, in vicinanza dell'apice, e dell'altro al punto di unione della cava superiore con l'atrio destro.

2. L'apporto di ossigeno al muscolo cardiaco è il fattore indispensabile per ottenere la ripresa completa. Quando questo requisito è rispettato si può ottenere la defibrillazione e la ripresa del ritmo normale solo con lo shock elettrico e senza massaggio entro 90-100 secondi. Se la fibrillazione dura più a lungo, e si è iniziato il massaggio cardiaco er riossigenare il cuore, è ancora possibile la defibrillazione e la ripresa del ritmo normale mediante lo shock elettrico. Se però si attende più di 4 minuti, il cane finisce per morire anche se il cuore abbia ripreso il suo ritmo normale.

3. In condizioni di ipossia è facile produrre fibrillazione ventricolare con shock elettrico; l'anossia da sola raramente può produrla. La fibrillazione può comparire anche dopo massaggio per arresto cardiaco. E' molto difficile defibrillare quando il cuore è anossico.

4. Quando in un cane normale si produce improvvisamente un arresto cardiaco, si può rimediare mediante respirazione artificiale, massaggio cardiaco e shock elettrico con correnti opportune, purchè si inizino le manovre entro 8 minuto, oppure entro 4 minuti dalla scomparsa del polso femorela.

5. In 2 casi clinici si ottenne la defibrillazione e la ripresa del ritmo normale con lo shock elettrico, rispettivamente dopo 31 e 41 minuti dall'inizio della fibrillazione. Il secondo tuttavia morì improvvisamente dopo 4 ore.

6. I risultati sperimentali sono transferibili nel campo della patologia umana.

### SUMARIO

O choque elétrico tem sido usado na fibrilação ventricular determinando a parada cardíaca seguida do restabelecimento do rítmo normal. Os autores, em estudo experimental em cães, chegaram aos seguintes resultados:

1. Quando uma corrente elétrica adequada é aplicada ao eixo longitudinal do coração, o batimento cardíaco normal pode ser recuperado imediatamente depois da desfibrilação, sem que haja parada cardíaca completa. A corrente adequada nestes casos é de 100 a 130 volts e 0.9 a 1.8 ampères no cão, e a duração do estímulo é de 0.05 segundos. A estimulação ao eixo longitudinal do coração indica um método de estímulo de um eletrodo, colocado na face superior do ventrículo esquerdo, logo acima da ponta, à um outro eletrodo que é colocado entre a junção da veia cava superior e a aurícula direita ao sulco terminal.

2. A suplência de oxgênio ao músculo cardíaco é o fator mais importante na recuperação após a fibrilação. Quando a respiração é mantida, a desfibrilação pode ser realizada e os batimentos cardíacos se restabelecem sem a necessidade de massagem dentro de 10 a 100 segundos, após a fibrilação. Si a fibrilação durar mais do que 90 a 100 segundos, e a massagem cardíaca fôr iniciada dentro de 4 minutos depois do ínicio da fibrilação, a desfibrilação pode ser realizada pelo choque elétrico. Nos casos em que a massagem cardíaca foifeita depois de passados 4 minutos da fibrilação, o cão morreu, embora tenha havido o restabelecimento dos batimentos cardíacos.

3. Sob condições hipóxicas, é facil produzir a fibrilação ventricular pelo choque elétrico; entretanto, é raro observar-se a fibrilação produzida ùnicamente pela anoxia. A fibrilação poderá ocorrer quando a massagem cardíaca foi o tratamento inicial da parada cardíaca. Sob condições hióxicas é muito difícil realizar a desfibrilação.

4. Quando um cão é bruscamente colocado em condição de apnéia, esta poderá ser aliviada pela respiração artificial, massagem cardíaca e choque elétrico, que deverá ser aplicado dentro de 8 minutos. Neste caso, a pulsação da artéria femoral desaparece cêrca de 4 minutos depois. Portanto, êstes métodos devem ser aplicados dentro de 4 minutos após o desaparecimento da pulsação da artéria femoral.

5. Dois pacientes foram desfibrilados e recuperaram os batimentos cardíacos após o choque elétrico. Em um caso isto occorreu 31 minutos e no outro 41 minutos após o ínicio da fibrilação. Este último paciente morreu 4 horas após.

6. Os resultados obtidos na experimentação mostraram ser aplicáveis à clínica.

### RÉSUMÉ

Le choc électrique est souvent utilisé pour transformer la fibrillation cardiaque en un arrêt total du coeur, après quoi on a pratiqué un massage cardiaque ou une autre méthode qui permettra d'obtenir de nouveau les pulsations normales. Le coeur pourra accidentellement rebattre normalement, mais dans ces circonstances la fibrillation apparaîtra bientôt de nouveau.

En utilisant des chiens, l'auteur a obtenu les résultats suivants:

1. Quand un courant électrique approprié était appliqué dans l'axe longitudinal du coeur durant une période convenable, les pulsations cardiaques normales peuvent être obtenues immédiatement après la défibrillation, sans qu'il y ait entretemps un arrêt complet du coeur.

Dans ces cas, le courant utilisé est de 100 à 130 volts et de 0,9 à 1,8 ampères pour le chien, et la durée de la stimulation est de 0,05 seconde. La stimulation dans l'axe longitudinal du coeur est une méthode de stimulation qui consiste a placer d'une part un électrode sur la surface postérieure du ventricule gauche, juste au niveau de la pointe, d'autre part un autre électrode placé au niveau de l'angle formé par la

veine cave supérieure et l'oreillete.

2. L'oxygène au muscle cardiaque est le facteur le plus important qui donne la possibilité à l'animal de guérir complètement de la fibrillation.

Quand on maintient la respiration par de l'oxygène pur ou de l'air simple, la fibrillation ne peut être arrêtée. Les battements du coeur réapparaissent seulement par le choc électrique sans massage, dans l'espace de 90 à 100 secondes après le début de la fibrillation.

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# Intestinal Fistula

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A HIGH intestinal fistula is a most serious and distressing condition that may lead to fatal consequences. The food taken by mouth is rapidly expelled through the fistula, and malnutrition soon follows. The most serious consequences are due primarily to loss of gastric and intestinal juices, accompanied frequently by loss of bile. All this loss may total as much as 4,000 cc. daily, even though no liquids are taken by mouth. Loss of sodium and chlorides causes dehydration, change in the acid-base balance of the blood, and hypochloremia. Loss of hydrogen ions in gastric juices produces alkalosis. Dehydration and renal dysfunction are responsible for hyperazotemia. Hypopotassemia is a frequent occurrence. The picture is similar to that associated with obstruction with profuse vomiting (Morton and Pears). The effects of drainage of all gastric juices outside the body were clearly demonstrated by Dragsted. The continuous loss of pancreatic juices has been shown to be fatal.

The effects of enzyme action upon the tissues which are in contact with the intestinal fluids may produce further deterioration of the condition due to secondary infection, pain and mental anguish. A typical vicious cycle develops, which complicates the situation and requires immediate corrective measures.

The treatment of this condition is aimed primarily at counteracting the devastating effect of the fluid loss by correction of the blood chemical content and so preventing tissue damage of the area surrounding the fistula opening. These palliative measures help only to achieve the ultimate aim of treatment. which is closure of the fistula.

Evaluation of the intake and output of fluids, as well as frequent determination of the values for blood urea, chlorides, carbon dioxide, potassium and serum protein, is necessary for management of the replacement therapy instituted parenterally. Although good results have been achieved in a number of cases by intravenous administration only (Hull and Barnes), there are still a significant number of cases in which other means of treatment must be used. Jejunal feeding (although often followed by cramps and diarrhea) and back feeding of the intestinal fluids should be tried.

For prevention of enzyme action upon the surrounding tissues, numerous methods have been devised. Some are based on chemical neutralization of the proteolytic ferments (by combining them with peptone powder, proteins, beef juice); others on mechanical absorption of ferments (with use of charcoal, kaolin, bronzing powder, etc.). Continuous irrigation of the wound with 1:10 solution of sodium chloride was advised by Potter. Mechanical removal of fluids by continuous suction is used. Wilkie devised a method in which two catheters were directed to the distal and proximal parts of the bowel so that the intestinal contents would be diverted back into the bowel. A specially adapted container for collection of expelled juices has been advised.

In the attempt to close a fistula, a number of surgical procedures have been advised. These, however, are frequently contraindicated because of the usual malnutrition of the patient and the low tendency of the wound to heal. The risk must nevertheless sometimes be taken when the fistula is accompanied by a distal obstruction. Closure of the fistula by mechanical means is therefore the method to which the surgeon most frequently is confined. The number of devices invented proves

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the difficulty of the problem.

Hartzel, in his paper "Treatment of Fistula of the Small Intestines," presented a review of the methods used in the attempt to close fistulas by mechanical means and added a description of his own method. According to this author, Judd and Phillips used chewing gum for obstructing the fistula orifice. Rigby and Hendon used gauze soaked in oil for plugging the fistula. Johnston devised two balloons, one inside and one outside the fistula, for obstruction of the opening. Reybard used a button placed in the lumen of the bowel and kept in position by an outside crossbar. Kleybolt used a similar device made of leather. A T tube was advocated by Kappis in 1911 to depress the mesenteric wall of the bowel, where often there is a tendency toward spur formation at the juncture of the efferent and the afferent loops. Dowd advised a small disc inserted in the bowel and held in place with sutures passed through a small obturator. C. M. Mayo used a bakelite button placed in the opening. Hartzel devised a refinement of the button and tube device held in place with sutures, the tube being molded from a wax model of the proper size and angle. Joseph used a Paul tube with success.

Most of these methods can be successful only with relatively small openings in the bowel and firm enough surrounding tissue to stand the pressure of traction. Large openings involving half the circumference of the bowel or situated at an angulation of the bowel are extremely difficult to treat by this means. A successful mechanical device should secure complete obstruction of the fistula and restoration of the continuity of the bowel, permitting normal feeding and preventing leakage of

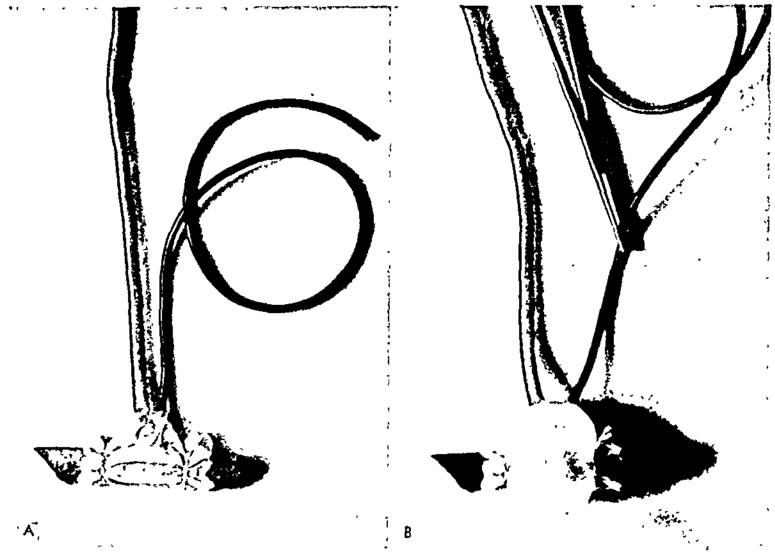

Fig. 1.—*A*, tube with balloon collapsed. One of the tubes leads to the balloon transverse short tube. *B*, tube with balloon inflated.

juices. This would rapidly improve the condition of the patient and would promote healing of the fistula, thus taking care of all the aspects of the problem.

Being faced with an extremely dramatic picture due to a high intestinal fistula occurring as a consequence of a surgical complication, I was able to prevent the certain tragic outcome with the device here described, constructed impromptu.

This device (Fig. 1) consists of a rubber T tube with the short arm slightly curved and of larger diameter (8 mm.). A fine rubber balloon is applied to the short arm of the T tube in an airtight fashion. (Fig. 1*A*). The balloon is fitted with a small caliber inflator tube. The arrangement is similar to the Foley catheter principle, applied to the short arm of the T tube. After determination of the direction of the proximal and the distal part of the bowel, the short arm of the T tube, with the balloon deflated is inserted into the lumen of the bowel, so as to bridge both parts. The long tube and the inflation tube emerge from the middle of the fistula opening. The balloon is now inflated (Fig. 1*B*) to a point where it obstructs completely the fistula opening. The inflation tube is then clamped. The patient is permitted to take fluids by mouth immediately. The long arm of the T tube is used for additional feeding and serves to keep the short branch constantly flushed out. When it is no longer needed the balloon is deflated and the emerging branches are cut short, the remainder being allowed to pass per rectum.

The illustrations will help to visualize the arrangement.

The case report will demonstrate the dramatic result achieved by the above described device.

### REPORT OF CASE

E. B., 41, an immigrant newly arrived from Afghanistan, was admitted to the surgical department on April 30, 1952. The chief complaint was of dull epigastric pain of ten years' duration. The pain was irregularly related to meals, and the patient took unspecified drugs for relief. Five months prior to admission the epigastric distress had become progressively worse.

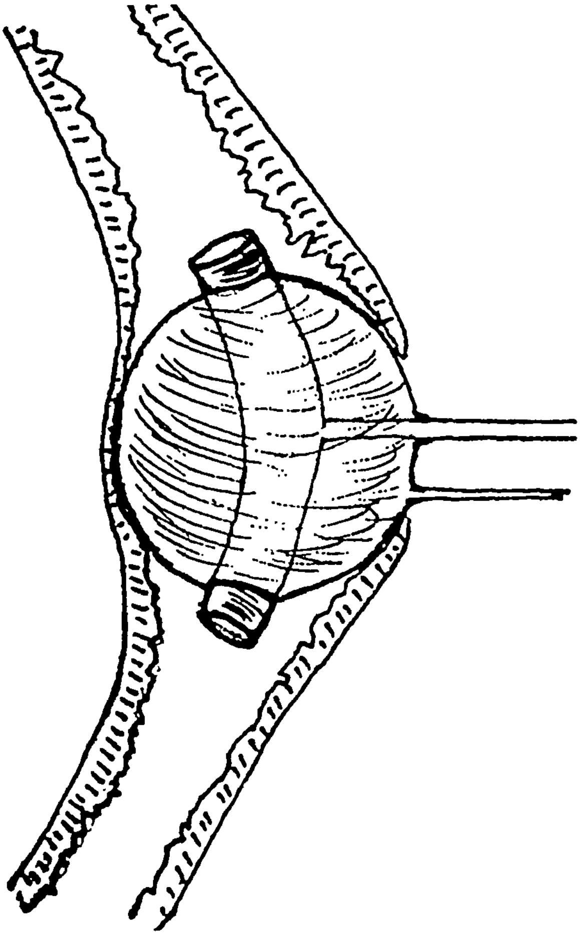

*Fig. 2.—Diagram of tube in intestinal lumen.*

The condition was diagnosed as duodenal ulcer and the diagnosis confirmed by roentgen study. In spite of treatment, consisting of drugs and diet, the patient's condition did not improve; on the contrary, he lost 10 Kg. of weight without relief of the epigastric distress. On admission he had been in good general condition. The results of routine laboratory tests were normal. Histamine tests showed a high gastric acid content (120 to 133). Gastrointestinal roentgenograms revealed a deformed duodenal bulb retracted cephalad and a possible communication between the duodenum and the common bile duct.

After medical treatment the symptoms were relieved. Operation, however, was considered advisable and was performed on May 6. At operation the pylorus was embedded in a thick mass of scar tissue. The choledochus and the gallbladder appeared normal. The first part of the duodenum was fixed to the head of the pancreas. A subtotal gastric resection was performed, with a Polpa type of anastomosis. The duodenum was transected above the ulcer, which was located on the posterior wall and was adherent to the pancreas. The duodenal stump was inverted and closed by two layers of sutures.

The postoperative course was complicated. On the day after the operation the patient was uncomfortable. The pulse rate was 140, the blood pressure dropped, and the abdomen was slightly tense. Intravenous fluids, blood and antibiotics improved the condition temporarily, but the following days witnessed a marked deterioration of the patient's condition. The abdomen became distended and tense. Jaundice developed, predominently on the lower part of the abdomen. Leakage from the duodenal stump was suspected, and operative exploration confirmed the suspicion. An abundant amount of bile was evacuated from the peritoneal cavity, and drainage was instituted. In spite of this, the patient's condition did not improve to the expected degree. Below the umbilicus a bulge appeared, and the impression was that bile was collecting in this region. Exploration revealed a large amount of bile collected in a peritoneal pocket. Here, too, a drain was placed. Two days later an intestinal fistula developed in the wound (most probably due to trauma), which rapidly increased. All food taken by mouth was eliminated through the fistula after one minute, indicating a high location. A spur formation protruded in the middle of the fistula, disconnecting completely the afferent and efferent portions of the intestine. An abundant quantity of gastric and pancreatic juices was expelled through the fistula. Besides this, through the drain placed close to the duodenal stump, an appreciable amount of bile continued to drain.

The general condition of the patient deteriorated rapidly. Dehydration, hypochloremia, alkalosis, hypoazotemia and hypopotassemia were pronounced in spite of intensive replacement therapy. Cachexia developed. The local condition around the fistula worsened in spite of all preventive measures. The fistulous orifice measured 3 by 2 cm. In the middle of the opening the mesenteric side of the jejunum had formed a spur, interrupting completely the communication of the proximal and distal parts. The jejunal alimentation failed, owing to cramps and diarrhea. The situation was desperate, and at this time the aforedescribed device was introduced through the fistula into the lumen of the jejunum (Fig. 3). The inflated balloon tightly obstructed the fistulous opening, and the patient was permitted to take fluids by mouth immediately. His condition improved rapidly. After a short time the duodenal stump closed spontaneously, and granulation tissue started to cover the opening of the fistula. In about two weeks, when granulation tissue closely surrounded the tubes emerging from the wound, these tubes were cut close to the short arm of the T tube. The short arm, which was left in the lumen of the intestine, appeared in the stool about twenty-four hours later. The patient recovered completely.

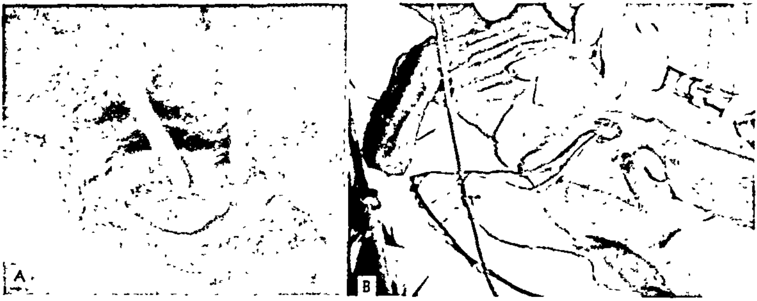

*Fig. 3.—A, tube in fistula. Character and size of fistula are shown. Inflated balloon obstructs the orifice of the fistula. B, tube inflated in position; jejunal feeding through long branch of T tube.*

The efficiency and ease of construction of this device may suggest the application of the same principle in the management of purposely constructed enterostomies, which are sometimes so difficult to care for and so distressing to the patient.

### SUMMARY

The sequence of clinical events in the presence of high intestinal fistulas are described and the methods of treatment reviewed.

A device that fulfills the requirements and treatment is described. A case is reported, in which this device proved lifesaving. Further application of the principle is suggested.

### ZUSAMMENFASSUNG

Der Gang der klinischen Entwicklung beim Bestehen hochgelegener Dünndarmfisteln wird beschrieben, und die Behandlungsverfahren werden kritisch geprüft. Eine Vorrichtung, die allen Anforderungen entspricht, und deren Anwendung werden beschrieben. Ein Fall wird berichtet, in dem die Vorrichtung sich als lebensrettend erwies. Weitere Anwendung des dargestellten Prinzips wird angeregt.

### RESUMEN

Se describe la secuencia de eventos clínicos en presencia de fístulas intestinales altas y se revisan los métodos de tratamiento. Se describe un recurso que llena los requerimientos y tratamiento. Se comunica un caso en que dicho recurso probó salvar la vida. Se sugieren posteriores aplicaciones del principio.

### SUMARIO

A seqüência de acontecimentos clínicos na presença de fístulas intestinais altas é descrita e. os métodos de tratamento são revistos. Um método que preenche os requisitos e o tratamento, é descrito. O autor comunica um caso, no qual êste método salvou a vida do paciente. A aplicação ulterior do princípio é sugerida.

### RIASSUNTO

Dopo una esposizione dei dati clinici e dei metodi di cura relativi alle fistole digiunali, viene descritto un apparecchio che risponde alla necessità terapeutiche; tale apparecchio è stato usato con successo in un caso e può essere impiegato anche in altre condizioni.

### RÉSUMÉ

L'auteur décrit la succession des symptômes dans les cas de fistule intestinale de la partie supérieure de l'abdomen et passe en revue les méthodes de traitement. L'auteur rapporte un cas dans lequel sa méthode a sauvé la vie du malade. Il suggère l'application de ce traitement pour d'autres cas.

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# Diced Cartilage Grafts

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DICED cartilage grafts, as the name suggests, consist of numerous small segments of cartilage that can be packed or molded into any desired contour like wet grains of sand. The term "diced" is descriptive, because in early cases the grafts were obtained[1] by pinning a segment of rib cartilage to a wooden block, making linear cuts in the cartilage, and then cross-cutting the rib, much as a cook dices carrots in preparing a salad. In practice, however, the small segments were used in the form of flat shavings rather than cubes, because the thin shavings pack together without presenting sharp corners, which may produce a prominence beneath the overlying skin.

*Use in Skull.*—Diced cartilage grafts were first used by myself in skull depressions, the multiple segments being introduced into the cavity and gently patted into a rounded contour. The scalp was then sutured over the rounded surface of the cartilage mass. This method provides a smooth, even contour and is so simple in execution that in the hands of a good operating team, with good operative assistance, a large depression in the frontal region can be repaired in an hour.

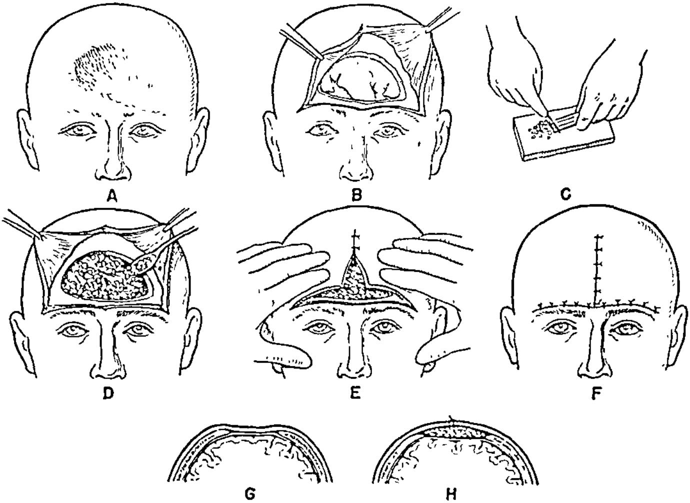

Fig. 1.—Successive steps in method of using diced cartilage grafts to fill a deep depression in the skull. The author invented diced cartilage grafts and used them for this type of repair at St. Barnabas Hospital twelve years ago.

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Submitted for publication July 6, 1954.

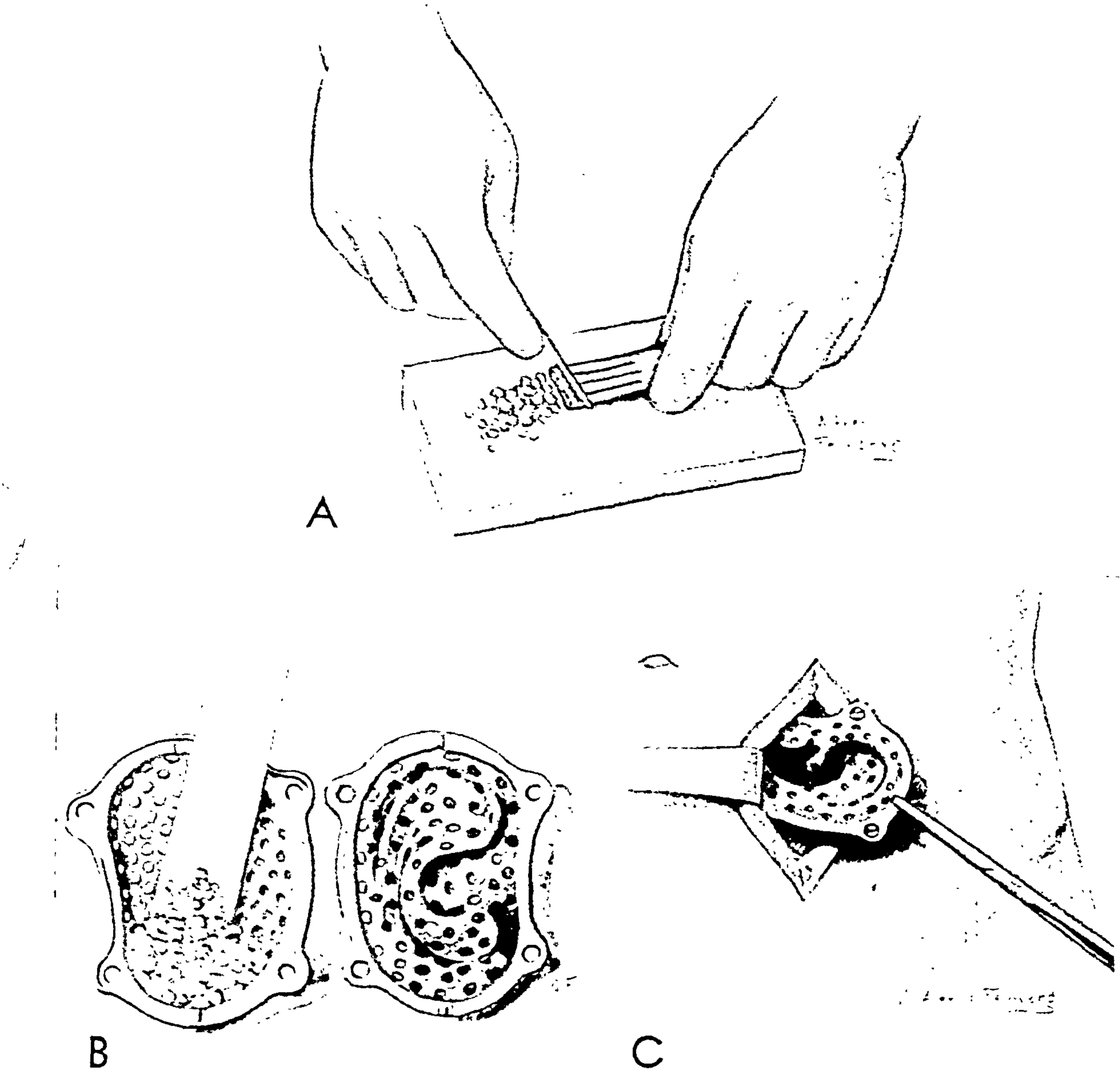

Fig. 2.—Formation of ear frame work from diced cartilage grafts inserted in vitallium ear mold—*A*, rib cartilage removed from the right side of the patient's chest is diced into many small cartilage cubes. *B*, the "diced cartilage grafts" are introduced into each half of a perforated vitallium ear mold. *C*, the two halves of the ear mold have been fastened together with vitallium screws, pressing the diced cartilage grafts into the shape of an ear. The mold containing the cartilage segments is inserted in a pocket beneath the patient's abdominal skin. During a period of months, blood vessels and connective tissue grow through the openings in the mold and fasten the separate cartilage cubes firmly together in the form of an ear.

Microscopic examination of the diced cartilage grafts after transplantation has been made at various intervals up to four years. The sections demonstrated that the spaces between the small cartilage segments were occupied first by blood and later by ingrowing connective tissue, accompanied by numerous small blood vessels. Each small cartilage graft rested against adjoining cartilage at some points

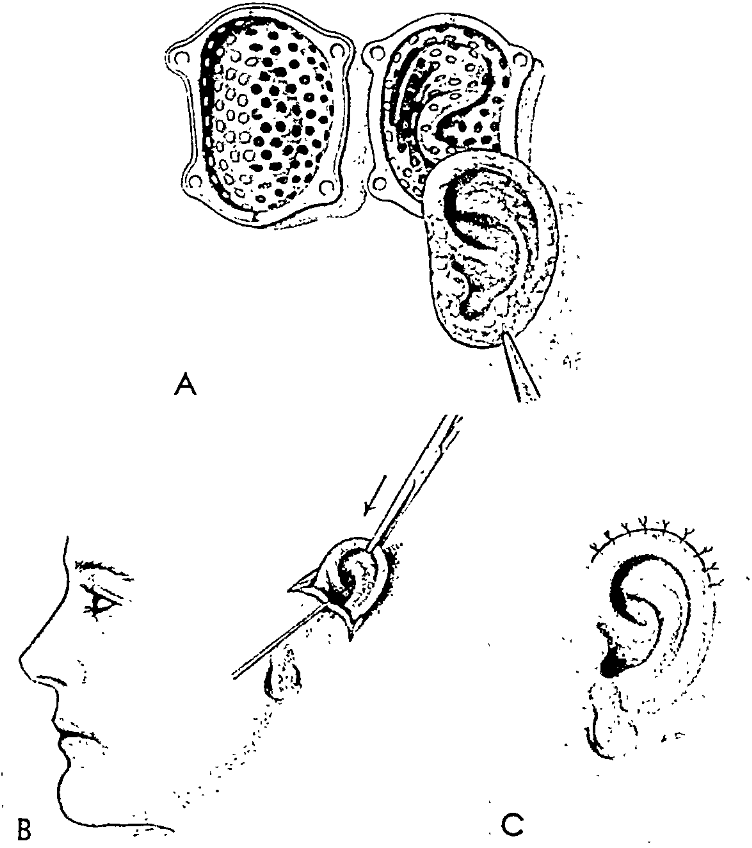

Fig. 3.—Removal of diced cartilage ear from mold and transplantation into ear region.—*A*, the vitallium ear mold has been removed from the abdominal pocket five months after burial in the abdominal area. The two halves of the mold have been separated and the diced cartilage ear framework removed from the mold. B, the diced cartilage ear framework is inserted into a previously delayed pocket beneath the skin in the ear region. The framework is about 1 inch (2.5 cm.) higher than the normal ear, to allow for subsequent sagging. *C*, the wound edges are sutured and a firm dressing is applied to press the skin against the cartilage framework. A drain may be inserted in the lower angle of the wound. The drain is removed after forty-eight hours without disturbing the *firm dressing that holds the skin against the cartilage.*

(with a thin layer of connective tissue between), thus preventing contracture of the cartilage mass. The bulk of the diced cartilage grafts collectively was increased by the addition of the numerous small spaces between the cartilage, and for this reason the diced cartilage grafts actually filled a larger space than did the solid rib cartilage from which they were cut.

Autogenous diced cartilage grafts had living chondrocytes, a normal-appearing matrix with occasional bone formation inside or outside the grafts, and a general absence of invasion and absorption. Some preserved diced cartilage grafts showed definite invasion and absorption, whereas in others the matrix, with dead cells, appeared to resist invasion quite well. The tendency to bone formation was more pronounced in preserved cartilage than in autogenous cartilage.

Diced cartilage grafts, in my opinion, have a usefulness, in repairing depressions in the frontal region of the skull, equal to that of any other method in current use. From a theoretical standpoint, the effectiveness of bone grafts should be greater than that of cartilage, since in using bone the surgeon is replacing an absent tissue with a similar one. Late examination of skull depressions repaired with iliac bone demonstrates considerable absorption in some cases, but the reduced bone graft appears to have bony contact with margins of the skull bone and thus provides protection for the brain. Some neurosurgeons[2] hold that autogenous grafts of skull bone, when used as free grafts, do not make bony contact with the adjacent skull bone of the host. Horrax of the Lahey Clinic has expressed the opinion that only a fibrous union occurs in such cases, but in the opinion of Grant[2] an osseous union is formed.

Tantalum plates and other foreign bodies are useful in the treatment of elder-

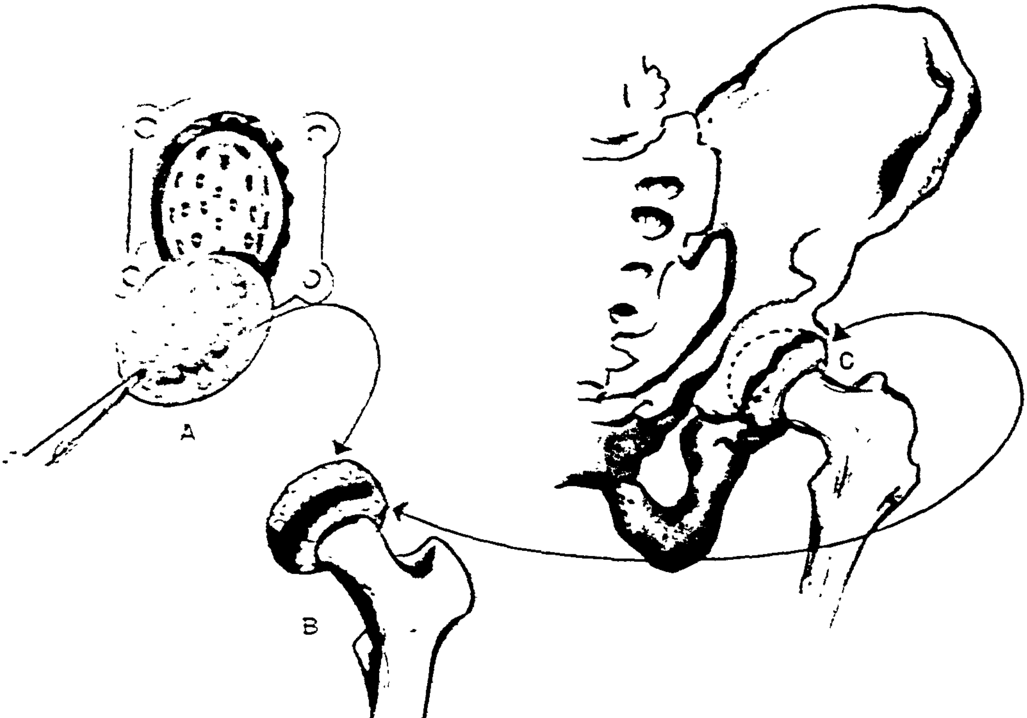

Fig. 4.—The principle of the ear mold applied to ankylosis of the hip joint. Orthopedic surgeons are beginning to realize that steel ball and socket joints are foreign bodies in human tissues. (*Collaboration with Dr. John Flanagan of Newark, N. J.*)

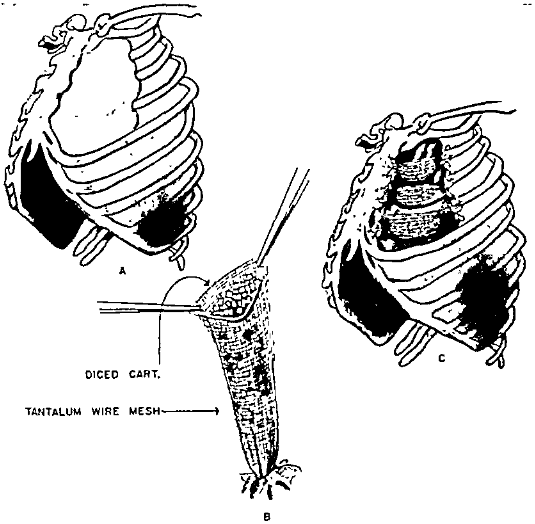

Fig. 5.—Diced cartilage grafts utilized to form new ribs to protect the heart (*collaboration with Dr. Henry Brodkin of Newark, N. J.*)

ly patients with skull defects and of cancerous patients with doubtful prognoses. Diced preserved cadaver cartilage grafts, rather than autogenous cartilage, may be employed as a substitute for metallic foreign body implants when the prognosis is doubtful.

*Other Uses in the Facial Region.*—Diced cartilage grafts have also been used as a substitute for bone grafts to repair mastoid fistulas, to build out the prominence of the malar bone in the correction of receding chin and, indeed, to restore contour in any bony deficiency of the face.

Grafts of this type packed in a perforated vitallium mold will conform to the shape of the mold like wet sand in a sand mold.[4] When a perforated ear mold is filled with cartilage segments and buried beneath the patient's abdominal skin, connective tissue and blood vessels grow through the openings in the mold. *In situ* they nourish the cartilage and fasten the separate segments together in a solid plaque. If the mold remains in place for about five months the plaque will be bound together by mature connective tissue with tough collagenous fibers, so that the cartilage can be removed from the mold as a solid ear structure. This cartilage framework may be inserted beneath the skin in the region of an absent ear to form the structural support for a new auricle.

It is interesting to note that the cartilage plaque is entirely autogenous, being composed of the patient's own cartilage, which is bound together by autogenous connective tissue and supplied by autogenous blood vessels. The cells and matrix of the cartilage, the connective tissue, and many of the blood vessels survive this free transplantation, and a new blood vessel supply arises mainly through end-to-end anastomosis between severed blood vessels in the host bed [illegible] in the graft. Some new [illegible]

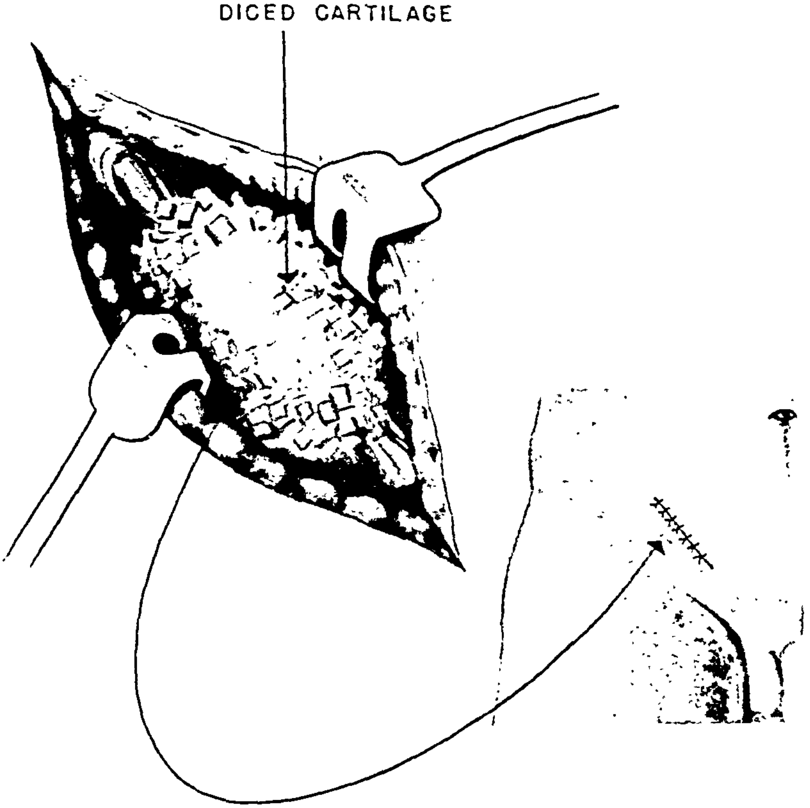

Fig. 6.—Diced cartilage grafts to reinforce deficient fascia in recurrent hernia (*courtesy of Dr. George Simms of Rutherford, N. J.*)

growth occurs from the host vessels into the substance of the graft connective tissue. Probably this new penetrating capillary growth later connects with the surviving vascular system of the graft.

*Diced Cartilage Grafts in Other Surgical Fields.*—The extreme malleability of diced cartilage grafts and the conformity of small segments to a perforated mold of any desired shape led me to suggest their use to a number of surgical colleagues at St. Barnabas Hospital. Dr. John Flanagan of Newark became interested in the idea and designed a perforated vitallium mold in the shape of a thin concave-convex disc that might be employed, on the ear mold principle, to form a new articular surface of cartilage. If inserted over the head of the femur, the cartilage disc might permit movement in the presence of ankylosis of the hip joint. The vitallium mold* was filled with diced segments of a patient's rib cartilage and buried beneath the abdominal skin. When the mold was removed after four months, the segments of cartilage were firmly bound together in the form of a thin cartilage cap. With the cap insertea as a cover for the head of the femur, the patient at the time of writing, eight months after the operation, is walking and bearing weight about as well as if a vitallium cap had been used.

Dr. George Simms of Rutherford, New Jersey, has successfully used diced cartilage to reinforce the fascia in cases of recurrent ventral and inguinal hernia. One of his patients with a large ventral herniation had a recurrence of the hernia after operative repair with a dermagraft. At a second operation, diced cadaver cartilage grafts from the cartilage bank were introduced over the surface of the thin muscle fascia and in some areas directly over the peritoneum. The subcutaneous tissue and the abdominal skin were then sutured over diced cartilage grafts, and a firm pressure dressing was applied. The diced cartilage grafts became bound together by connective tissue in the form of a large pancake-like plaque, which served as an internal or buried truss. The patient had had no recurrence of this large ventral hernia two years after operation.

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*Made by the Austenal Company of New York City

With my assistance, Dr. Henry Brodkin of Newark has built up several new ribs to protect the heart in patients who had undergone extensive removal of the cartilage. This was accomplished by introducing diced cadaver cartilage grafts into tantalum mesh and fastening the open ends of the mesh with a purse-string wire suture to retain the mass of segments within the mesh. The tantalum mesh, with its content of cartilage, was sutured to the sternum at one end and to the posterior rib segments horizontally at the other end, or, in some instances, in a vertical direction, so as to bridge the defect in the thoracic cage. Connective tissue grew through the openings in the mesh and bound the cartilage segments together in the form of a solid rib structure, which served to give support for the soft tissues of the chest and to provide protection for the heart.

In collaboration with Dr. Robert Green of South Orange, New Jersey, I have used diced cartilage for filling large bony defects in infants with spina bifida. The method is indicated particularly in patients with a large cord herniation, associated with an extensive bony defect and insufficient fascia, muscle and skin for adequate closure and coverage. Double pedicle skin flaps are elevated at the sides and resutured in place to allow adequate blood supply to develop in the flaps. Two weeks later the thin skin covering the herniation is removed, the cord elements reduced and the best possible closure obtained by suturing fascia and muscle over

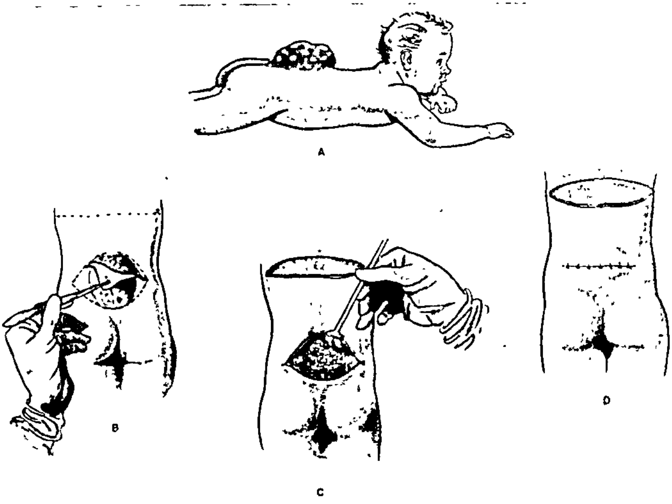

Fig. 7.—Diced cartilage grafts for repair of large spinal cord defect in spina bifida (*collaboration with Dr. Robert Green of South Orange, N. J., and Dr. Richard Swain of Newark, N. J.*)

the bony defect. Diced cadaver cartilage grafts are then introduced over the fascia and muscle and sometimes directly over the cord content. A sheet of tantalum or stainless steel screen may be sutured over the defect to keep the diced cartilage grafts out of the spinal cord opening when fascia and muscle closure is inadequate. The lateral skin flaps are then elevated and sutured to cover the plaque of the grafts. If the child does not die from hydrocephalus or meningitis, the diced cartilage grafts will become bound together by fibrous tissue and the solid plaque will prevent herniation of nerve elements from the spinal cord.

## SUMMARY

It appears that diced cartilage grafts may have a much wider field of application than was originally supposed. The author first designed and employed them to fill depressions in the skull and defects about the face. Later the grafts were packed in a perforated ear mold, and when this mold, with its cartilage content, was transplanted into human abdominal fat, the separate segments became bound together by ingrowing fibrous tissue, so that a solid structure was formed which accurately represented the shape of the mold.

The method of simply introducing the cartilage grafts to fill a cavity or to prevent herniation as in skull depressions, inguinal and ventral hernia and spina bifida, and the method of inserting the grafts in a special mold or form, as in ear reconstruction, ankylosis of joints and the for-
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The simple procedure of introducing living or dead cartilage grafts into a cavity or the method of packing them in a mold may be selectively employed in different surgical fields for various purposes.

It is fortunate that cadaver bank cartilage grafts are usually well tolerated by human tissues. This allows the surgeon to provide support for extensive defects in the chest wall, for herniation of both sides of the abdomen, and for extensive spinal and other skeletal deficiencies in infants and young children when it is not wise to use the patient's own cartilage.

One should bear in mind, however, that autogenous tissues are always better, as free grafts, than the tissues of another person. Obviously, cadaver cartilage must be used when the patient's own cartilage cannot be obtained in sufficient quantity.

## RESUMEN

El autor describe su técnica de implantación de injertos cartilaginosos cúbicos, que él uso primeramente para llenar depresiones craniales y defectos faciales y que ha usado con éxito en reconstrucción de la oreja. Recomienda los injertos también para otros propósitos. El cartílago autógeno es preferible, pero el cartílago del banco obtenido de cadaver es también bien tolerado por los tejidos humanos y puede emplearse en la reparación de grandes defectos de la pared torácica, hernia de cualquier lado del abdomen y defectos vertebrales u otros óseos en niños y jovenes.

## ZUSAMMENFASSUNG

Der Verfasser beschreibt seine Technik der Einpflanzung würfelförmiger Knorpeltransplantate, die er erst zur Ausfüllung von Eindellungen des Schädels und von Defekten der Gesichtsknochen und später mit Erfolg zur Wiederherstellung der Ohrmuschel verwandte. Er empfiehlt diese Transplantate auch zu anderen Zwecken. Autogener Knorpel verdient zwar den Vorzug, aber auch Knorpel von Leichen aus einer Gewebebank wird vom menschlichen Organismus gut vertragen und kann zur Reparatur grösserer Brustwanddefekte, von Bauchbrüchen und umfangreichen Defekten der Wirbelsäule und anderer Knochen bei Säuglingen und jungen Kindern verwendet werden.

### RÉSUMÉ

L'auteur décrit sa technique de greffe cartilagineuse qu'il a utilisée en premier lieu pour réparer des dépressions cutanées. Actuellement il l'emploie avec succès pour la reconstruction de l'oreille et pour d'autres défects. L'auto-cartilage est préférable, mais celui provenant des banques est bien toléré. Il peut être utilisé pour réparer la paroi thoracique, consolider une hernie, armer une colonne vertébrale déficiente chez les nourrissons et les jeunes enfants.

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*The meaning of the word vanity never crosses the vulgar heart.*

The longing to be primitive is a disease of culture; it is archaism in morals. To be so preoccupied with vitality is a symptom of anaemia.

For an idea ever to be fashionable is ominous, since it must afterwards be always old-fashioned.

By nature's kindly disposition most questions which it is beyond man's power to answer do not occur to him at all.

A way foolishness has of revenging itself is to excommunicate the world.

The mind celebrates a little triumph every time it can formulate a truth.

—*Santayana*

# Treatment of Complete Rectal Prolapse with Sclerosing Agents

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ELIZABETH, NEW JERSEY

PROCIDENTIA of the terminal portion of the bowel may be divided, for therapeutic purposes, into classifications: Sigmoid procidentia (sliding hernia, intussusception of the sigmoid into the rectum) and rectal procidentia (beginning in the ampulla). In either case all the coats of the bowel are involved. In this communication only the treatment of complete rectal procidentia will be considered, that is, prolapse that starts in the rectal ampulla. For sigmoid procidentia some form of repair of the anatomic defect in the pelvic fascia, together with the additional fixation of the sigmoid colon, is the treatment of choice.

The appearance of the extruded bowel is typical and is characterized by the circular arrangement of the striations (Fig. 1), in contrast to the smooth outline of mucosal prolapse.

A variety of surgical procedures have been advocated for the cure of this condition. Dickson Wright[1] enumerated thirty-six methods that have been employed at one time or another by various surgeons. The more widely recognized treatments are: the anal tightening operation of Thiersch;[2] the pelvic obliterating operation of Moschowitz;[3] some modifica- of the Moschowitz procedure,[4] and resection of the prolapsed bowel.[5]

There are several nonoperative procedures, among which is the injection of sclerosing solutions. This may prove to be an effective technic when limited to treatment of prolapse of the rectal ampulla. It is especially applicable to senile or debilitated patients. A number of its advocates may be mentioned, with the solutions and technics applied. Hanes[6] advocated the injection of 50 to 60 cc. of 1:3,000 C.P. hydrochloric acid into the perirectal spaces. Frankfeldt[7] utilized a modification of the Swinford Edwards treatment, in which a sterile solution of quinine sulfate and diluted sulfuric acid in distilled water is injected into the perirectal spaces. In addition, 5 per cent phenol in almond oil is injected submucously, intrarectally, through a proctoscope. Terrell[8] and Gaume[9] advised the injection of 5 per cent aqueous solution of quinine and urea hydrochloride submucously around the circumference of the prolapsed bowel. Hayes and Burr[10] employed several ounces of 1 per cent phenol in castor oil, injected above the levators at each side and posterior to the rectum. These authors reported satisfactory results have been obtained when a combination of these methods was used.

This report is concerned with 2 cases of chronic recurring rectal procidentia, treated with sclerosing solutions. The indication in the first case was failure of surgical repair of the prolapse and in the second the presence of a chronic debilitating disease.

*Rationale of Treatment.*—The injection of a sclerosing solution submucously and perirectally produces a chemical inflammation with a resultant fibrinous exudate. In the first instance this cements the mucosa and the submucosa to the muscularis, forming a stiff, firm rectal wall and a permanent splinting of the bowel precluding future prolapse. The perirectal injection results in the production of a dense fibrinous exudate which binds the rectum to the perirectal tissues, thereby giving support to the organ.

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*Preoperative Preparation.* — The bowel must be completely emptied by 2 ounces of castor oil. When this agent has acted, a series of enemas is given until the colon is thoroughly emptied of fecal material. This usually takes about two days, and during this period the diet should be a liquid non-residue diet including the elimination of milk. When there is danger of postoperative infection, as in the second case to be reported, prophylactic treatment with an antibiotic and sulfonamide is indicated. The second patient, therefore, was given, for four days preoperatively, a daily injection of 1 Gm. of dihydrostreptomycin sulfate with 400,000 units of penicillin (combiotic, Pfizer) and 90 gr. of sulfaphthalidine in four divided doses. He was also tested intracutaneously for quinine sensitivity, with a negative result. The first patient received no special preoperative preparation except the castor oil and enemas.

A sedative consisting of sodium pentabarbital, 1½ gr. to each patient was administered on the night prior to the operation, and morphine sulfate (1/6 gr.) and atropine sulfate, (1/150 gr.) was given hypodermically half an hour before the operation. A low "saddle" spinal anesthesia was induced 50 mg. of procaine hydrochloride being used for the first patient and 75 mg. for the second.

In each instance the patient was placed in the lithotomy position. The perianal skin was painted with an antiseptic solution and draped with sterile towels and sheets. The prolapsed bowel was cleansed with alcohol and sterile saline solution preparatory to the injection treatment.

Manipulation of the mass was facilitated by application of two or three Pennington clamps around the circumference of the bowel. A description of the multiple method follows.

*Technic.*—(a) *Submucous Injection* (after Gaume[9]): Two or three 5 cc. Luer Lok syringes with ½ inch, 27 gauge needles are filled with 1 per cent quinine and urea hydrochloride solution to be used as needed. The first series of injections begins at the outermost part of the mass, that is, the lumen of the bowel. Here 2 to 3 mins. of the solution is injected about ¼ inch (0.6 cm.) deep, submucously, at about 1 inch (2.5 cm.) intervals around the entire circumference of the prolapsed bowel. The reason for making the first series of injections as far out on the bowel as possible is the fact that, when the mass is replaced, it will anchor the beginning of the procidentia. The next row of solution is deposited ½ inch (1.2 cm.) above the first, the punctures in the inter-puncture space being staggered until, with seven or eight rows, the anus is reached. The solution is injected at these intervals and the punctures are staggered because the fibrosis induced extends so far outward that it practically interlocks one site with the other over the whole area of the treated portion of the bowel. The fibrosis induced constitutes a permanent splint, rigid, firm and incapable of being extruded. In the cases to be reported a total of 24 cc. of 1 per cent quinine and urea hydrochloride was used. A 5 per cent solution, if the sensitivity test for quinine gives a negative result, may be used in more robust patients.

Bleeding is minimal because the larger vessels, which are usually visible, are avoided. The mass is then replaced.

(b) *Perirectal Injection:* A 10 cc. Luer Lok syringe fitted with a 3½ inch to 19 inch (7.5 to 27.5 cm.) gauge needle is filled with warm 1 per cent phenol in sterilized castor oil. (A 5 per cent solution may also be used.) The lubricated index finger of the surgeon's left hand is inserted into the rectum. From a point 1 inch (2.5 cm.) from the anal verge, the needle is plunged into the tissues to its entire length in both lateral and posterior perirectal spaces. The solution is slowly injected as the needle is withdrawn. It is important to flood the solution right alongside the bowel wall, since ultimate success depends upon the amount of fibrosis produced to hold up the prolapse. The accumulation is palpable and should be massaged for about one minute to prevent pooling of the solution. Care must be exercised in the posterior injection to avoid perforating the bowel. A ½ inch (0.6 cm.) soft rubber tube, covered with several layers of petrolatum gauze, is inserted high up into the sigmoid. The protruding end is cut and sutured to the skin of the anal margin. The purpose of the tubing is to appose the muscularis to the mucosa and the rectum to the perirectal tissues, as well as to act as a flatus tube. A voluminous compression dressing, kept in place with a T binder, is then applied.

*Postoperative Care.*—The tube remains in place for four days. Prior to its removal, 6 ounces of warm vegetable oil is injected as a retention enema to facilitate the first bowel movement. During this period the patient is given a low residue diet and ½ ounce mineral oil twice daily, by mouth. The patient must use a bedpan to evacuate the bowel for at least one or two weeks. The diet is rapidly increased after the fourth day to the standard hospital diet, and the mineral oil is continued, with perhaps ½ ounce of milk of magnesia, administered at bedtime. This is supplemented with an occasional enema to insure a daily evacuation. Sphincter exercises, 20 to 30 contractions a day, are begun after removal of the rectal tube and are continued until sphincteric competence is obtained. Check-ups are made at monthly intervals to determine whether the sphincter exercises have accomplished the desired result.

## REPORT OF CASES

CASE 1.—O. R., a man aged 56, was admitted to the hospital on Dec. 28, 1942, with the history of a mass protruding from the anus. Since early childhood he had had trouble with recurrent protrusion of a small mass. He had no symptoms referable to the mass, which ordinarily he himself reduced. Gradually the mass increased in size and interfered with his bowel movements. Three years ago prior to admission he was operated upon for this condition but was not relieved. On the evening prior to admission the mass again protruded from the anus, and he could not reduce it. There was no nausea, vomiting or abdominal pain. Physical examination on admission gave essentially normal results except on rectal examination. Inspection revealed a protruding mass of bowel about the size of a grapefruit (Fig. 1). It was characterized by a circular arrangement of the striations. The mass was manipulated into the rectum with the liberal use of toilet tissue. Repeatedly prolapse occurred, however, with each bowel movement and frequently on ambulation. After due consideration of all the factors involved, including the incompetence of the sphincter, it was decided to treat the patient with sclerosing agents.

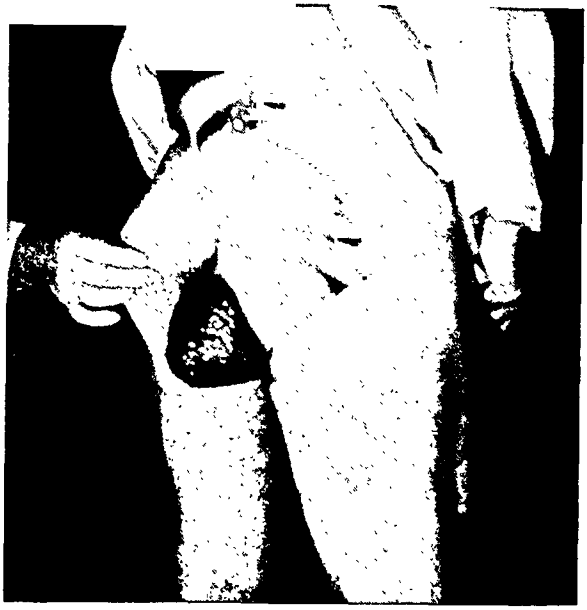
Fig. 1 (Case 1).—Protruding mass of bowel with circular striations (see text).

The patient was then prepared as aforedescribed. He was given a total of 24 cc. of 1 per cent quinine and urea hydrochloride submucously, and 1½ ounces of 1 per cent phenol in sterilized castor oil in the lateral and 1 ounce in the postanal space. He was discharged three weeks after the operation, at which time he was having a daily bowel movement and using the regular toilet facilities. He was instructed about the importance of sphincter exercises and told to continue them daily until sphincter tone returned.

The last prior examination of this patient took place in the early part of 1943. He was reexamined in February 1954. The rectal prolapse had not recurred, as was indicated by straining efforts to evacuate the bowel and by digital examination with the patient alternately stooping and in the left lateral position. The sphincter musculature, though not entirely competent, was sufficiently improved to enable the patient to control bowel movements satisfactorily.

CASE 2.—J. W. W., a man aged 58, was admitted to Bonnie Burn Sanatorium on Nov. 8, 1953, with the following diagnoses: pulmonary tuberculosis, far advanced, complicated by cardiovascular insufficiency, chronic nephritis, absence of the left kidney and procidentia recti. His disability was quite evident. He had observed prolapse of the bowel for the past three years, which ordinarily he was able to reduce, (Fig. 2). This had lately become more and more difficult as his debility increased. Examination revealed good sphincter control. He was treated with sclerosing solutions on Feb. 2, 1954, by the multiple technic aforedescribed. He was given a total of 24 cc. of 1 per cent quinine and urea hydrochloride, submucously, around the circumference of the prolapsed bowel, and 2 ounces of 1 per cent phenol in sterilized castor oil was injected in the left perirectal tissues, 1½ ounces in the right lateral perianal space and 1 ounce posterior to the rectum. The usual precaution of evacuating the bowels into a bedpan for the first two weeks was observed; thereafter the patient had normal daily evacuations at the regular toilet, without any evidence of prolapse. At no time was there any systemic reaction to the treatment. The patient has been reexamined periodically and appears to have been completely relieved of the rectal prolapse.

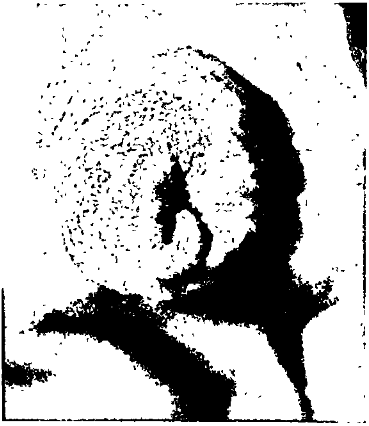

Fig. 2 (Case 2).—Prolapsed bowel in the case of J. W. W. (see text).

## SUMMARY

Procidentia recti must be differentiated from mucosal prolapse of the rectum. Complete prolapse, with the rectum turned inside out, can be chronic and slowly developing and is usually associated with a patulous sphincter ani. Its occurrence in children is infrequent, the more common condition being prolapse of the rectal mucous membrane. In the aged it is part of a general weakening process, especially at the openings of the abdominal cavity, that is, the esophagus, the inguinal region, the uterus and the rectum. Since in most cases the patients are past 60 years of age and do not wish to be subjected to radical operation, the plan outlined offers relief for this disabling condition by means of a comparatively simple procedure. It is a conservative solution to a difficult problem. The method deserves to be more widely known. Though a safe and relatively mild procedure, it gives results which heretofore have been obtained only by an operation of no little magnitude and danger.

The method is not complete unless proper consideration is given to treatment of the relaxed anal musculature. This is illustrated by the first case, in which some degree of patency of the sphincter ani allows anal fecal soilage. Besides lack of cooperation due to language difficulties, it appears that at the time of the sclerosing treatment (1942) insufficient consideration was given to the probable atrophy of the sphincter musculature. The Thiersch operations[2] appears to have been indicated at the time of the original operation. The continued sphincter exercises in the second case has returned sphincter control to normal.

In both cases the treatment has transformed a sorely distressed patient into a person with a comfortable life and normal bowel habits.

## SUMARIO

"Procidentia recti" deve ser distinguida do prolapso da mucosa do reto. O prolapso completo, com o reto exteriorizado, pode ser crônico e de desenvolvimento lento e é geralmente associado a um esfínter anal aberto. Sua ocorrência na infância e rara, sendo a condição mais comum o prolapso da membrana mucosa do reto. Nos indivíduos idosos constitue parte do processo geral de enfraquecimento, especialmente nas aberturas d cavidade abdominal, isto é, o esôfago, região inguinal, útero e reto. Como na maioria dos casos os pacientes têm mais de 60 anos e não desejam ser submetidos à operação radical, o plano esboçado oferece alívio à esta condição de incapacidade por meio de um processo comparativamente simples. E uma solução conservadora para um problema difícil. O método merece ser mais amplamente conhecido. Embora seja um processo seguro e relativamente suave, dá resultados que antigamente eram obtidos apenas por operação de maior gravidade.

O metodo não é completo a menos que tratamento adequado seja dado à musculatura anal relaxada. Isto é ilustrado pelo primeiro caso, no qual um certo grau de abertura do esfínter anal permite a defecação. Além da falta de cooperação devido a dificuldades linguisticas, parece que, por ocasião do tratamento esclerosante (1942), não foi dada atenção suficiente à provável atrofia da musculatura esfínteriana. A operação de Tiersch parece ter sido indicada por ocasião da operação original. Os excercícios esfínterianos contínuos no segundo caso restabeleceram o contrôle esfínteriano. Em ambos os casos, otratamento transformou um paciente portador de complexos numa pessoa com vida confortável e hábitos normais de defecação.

## ZUSAMMENFASSUNG

Der Vorfall des Mastdarms muss vom Prolaps der Mastdarmschleimhaut unterschieden werden. Eine vollständige Ausstülpung des Mastdarms kann ein chronischer Zustand sein, der sich langsam entwickelt und gewöhnlich mit einem offenen Schliessmuskel einher geht. Bei Kindern tritt die Erkrankung selten auf, während ein Prolaps der Mastdarmschleimhaut häufiger beobachtet wird. Im höheren Alter ist der totale astdarmvorfall ein Ausdruck eines allgemeinen Erschlaffungsprozesses, der besonders an den Öffnungen der Bauchhöhle, nämlich an der Speiseröhre, in den Leistengegenden, an der Gebärmutter und am Mastdarm in Erscheinung tritt. Da es sich meist um Kranke jenseits des 60. Jahres handelt, die sich im allgemeinen nicht gern einem grösseren chirurgischen Eingriff unterziehen, schlägt der Verfasser vor, diesen in ihrer Lebensweise stark Behinderten Patienten auf eine verhältnismässig einfache Weise zu helfen. Es handelt sich um eine konservative Lösung eines schwierigen Problems, und das Verfahren verdient, mehr als bisher bekannt zu werden. Die Methode ist gefahrlos und verhältnismässig schonend und zeitigt dennoch Ergebnisse, die sich sonst nur mit Hilft keineswegs geringfügiger und ungefährlicher Operationen erzielen liessen.

Das Verfahren ist nur dann vollständig, wenn die Behandlung der erschlafften Muskulatur des Afters angemessene Berücksichtigung erfährt. Dies geht klar aus dem Beispiel des ersten Falles hervor, wo ein gewisser Grad von Sphinktererschlaffung den Ausfluss von Kot gestattet. Das ist offenbar, von sprachlichen Schwierigkeiten, die keine enge Zusammenarbeit zwischen Arzt und Krankem gestatteten, abgesehen, darauf zurückzuführen, dass zur Zeit der Durchführung der Sklerosierungsbehandlung (1942) die wahrscheinlich bestehende Atrophie der Sphinktermuskulatur nicht genügend berücksichtigt wurde. Hier hätte wohl gleichzeitig mit dem vorgenommenen Eingriff die Thierschsche Operation ausgeführt werden sollen. Im zweiten Falle haben fortgesetzte Sphinkterübungen zur Wiederherstellung einer normalen Schliebmuskelkontrolle geführt.

In bieden Fällen gelan es durch die Behandlung aus einem schwer behinderten Kranken einen Menschen zu machen, der ohne besondere Schwierigkeiten mit normalen Stuhlgepflogenheiten leben kann.

### RESUMEN

La procidencia rectal debe ser diferenciada del prolapso mucoso rectal. El prolapso completo con el recto evertido hacia el exterior puede ser crónico y de desarrollo lento, asociéndose frecuentemente con dilatación del esfínter anal. Su incidencia en niños es rara, siendo lo más frecuente el prolapso de la mucosa rectal. En el viejo representa una parte en el proceso de debilitamiento general, especialmente localizado a las aberturas de la cavidad abdominal, esófago, región inguinal, utero y recto. Ya que la mayoría de los pacientes pasan de los 60 años de edad y no desean ser sometidos a una operación radical, el plan delineado ofrece alivio en este padecimiento por medio de procedimiento comparativamente sencillo. Es una solución conservadora a un problema difícil. El método merece ser más ampliamente conocido. Aun cuando se trata de un procedimiento seguro y relativamente menor, proporciona resultados que anteriormente eran obtenidos unicamente por una operación de no pequeña magnitud y peligro.

El método no es completo hasta que se dé la consideración adecuada al tratamiento de la musculatura anal relajada. Esto se ilustra en el primer caso, el el cual, cierto grado de luz del esfínter anal permitió ensuciamiento fecal anal. Además de la falta de cooperacién debida a dificultades de lenguaje, parece ser que durante el tiempo del tratamiento esclerosante (1942) se dió poca atención a la probable atrofia de la musculatura esfintérica. La operación de Thiersch 2 pudo estar indicada cuando la operación original. Los ejercicios constantes del esfínter en el segundo caso devolvieron el control esfintérico normal.

En ambos casos, el tratamiento transformó un paciente afligido en una persona con una vida confortable y evacuaciones intestinales normales.

### RIASSUNTO

Si deve distinguere la procidenza del retto del prolasso di mucosa. Il prolasso completo, col retto rovesciato all'esterno, può essere cronico e a lento sviluppo e di solito si accompagna a incontinenza dell'ano. E' raro nei bambini, nei quali invece è abbastanza frequente il prolasso mucoso. Nella vecchiaia compare come manifestazione di un quadro generale di indebolimento, che interessa tutte le aperture della cavità addominale, e cioè l'esofago, le regioni inguinali, l'utero e il retto. In molti casi i prolati hanno superato i 60 anni di età e rifiutano l'intervento, e pertanto è necessario ricorrere a metodi più semplici per curare questa infermità. Il metodo conservativo merita di essere conosciuto perchè è sicuro, semplice e permette di conseguire gli stessi risultati che si ottengono con l'intervento chirurgico. Esso mira a correggere il rilasciamento della muscolatura anale. Vengono illustrati due casi nei quali questo metodo consentì ai pazienti di riprendere vita, occupazioni e funzioni normali.

### RÉSUMÉ

La procidence du rectum doit être différenciée du prolapsus muqueux du rectum. Le prolapsus complet du rectum survient généralement progressivement, il est associé habituellement à un sphincter anal relâché. Son apparition n'est pas fréquente chez les enfants. Chez les vieillards cet état fait partie d'un relâchement tissulaire général. Citons: l'oesophage, la région inguinale, l'utérus, le rectum etc. Etant donné que dans la plupart des cas les malades ont dépassé la soixantaine, ils ne veulent pas se soumettre à une opération radicale, la méthode conservatrice proposée est intéressante et mérite d'être mieux connue. Elle est illustrée pour le premier cas, où le sphincter anal est relâché. On doit tenir compte de la greffe de Thiersch. Dans le second cas les exercices continus du sphincter ont rendu le contrôle sphinctérien normal. Dans les deux cas le traitement a transformé ces malades cruellement affligis.

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Every one is familiar with the phenomenon of feeling more or less alive on different days. Every one knows on any given day that there are energies slumbering in him which the incitements of that day do not call forth, but which he might display if these were greater. Most of us feel as if a sort of cloud weighed upon us, keeping us below our highest notch of clearness in discernment, sureness in reasoning, or firmness in deciding. Compared with what we ought to be, we are only half awake. Our fires are damped, our drafts are checked. We are making use of only a small part of our possible mental and physical resources. In some persons this sense of being cut off from their rightful resources is extreme, and we then get the formidable neurasthenic and psychasthenic conditions, with life grown into one tissue of impossibilities, that so many medical books describe.

Stating the thing broadly, the human individual thus lives usually far within his limits; he possesses powers of various sorts which he habitually fails to use. He energizes below his *maximum*, and he behaves below his *optimum*. In elementary faculty, in co-ordination, in power of *inhibition* and control, in every conceivable way, his life is contracted like the field of vision of an hysteric subject—but with less excuse, for the poor hysteric is diseased, while in the rest of us it is only an inveterate *habit*—the habit of inferiority to our full self—that is bad.

Admit so much, then, and admit also that the charge of being inferior to their full self is far truer of some men than of others; then the practical question ensues: *to what do the better men owe their escape? and, in the fluctuations which all men feel in their own degree of energizing, to what are the improvements due, when they occur?*

In general terms the answer is plain:

Either some unusual stimulus fills them with emotional excitement, or some unusual idea of necessity induces them to make an extra effort of will. *Excitements, ideas, and efforts*, in a word, are what carry us over the dam.

—*William James*

# Safeguards in Total Abdominal Hysterectomy

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SEVERAL well-standardized methods of hysterectomy are used in excising the uterus. They are classified as either total or subtotal and abdominal or vaginal, according to the surgical procedure or approach employed. The method is determined by specific indications related to the pathologic process and the surgical measures involved, and also to the personal preference, experience and adeptness of the surgeon. Much has been written about the merits and limitations of the various methods. The advantages of total hysterectomy are becoming more apparent, and its increased use is advocated, provided it can be performed with morbidity and mortality rates equal to those associated with supravaginal hysterectomy, or lower. However, unless total excision is accomplished by a safe method designed to prevent injury to important adjacent structures (ureter, bladder, rectum, etc.) and unless the surgeon has a thorough understanding of normal and pathologic variations in anatomic relations, these rates will obviously be higher, owing to the more intimate association of these important structures in the area of necessary dissection about the cervix. The Richardson method of conservative abdominal hysterectomy,[1] or one of its modifications,[2] provides an opportunity for safe removal. Additional emphasis and explanation of some of the facilitating steps employed in this excellent procedure, especially as they obviate some of the so-called dangers and disadvantages, seems worth while. The significance of complications resulting from injuries in pelvic and uterine surgical treatment is well known; their frequency is understandably unknown, being only rarely reported or discussed.

Repetition is extremely valuable in the teaching and practice of surgery. Added emphasis on the safeguards and practical aspects of surgical technic is also important in obtaining improved results. The routine technical steps in various methods of hysterectomy, including the Richardson method, have been well described and illustrated.[3] It is our desire to offer further illustration and clarification of some of the factors and technical points involved in the application of the Richardson method, as they have aided us in the performance of total hysterectomy.

The abdominal route of hysterectomy is a highly popular one. The recent significant medical advancements and high development of surgical skill, with the resultant safety in surgical procedures, plus the demand for, and the added value of, simultaneous abdominal exploration and indicated correction of associated problems, account for this popularity. Although the morbidity and mortality rates show considerable variation in the literature, they are usually reported as very low in the carefully studied series from the better clinics and hospitals. Yet, because of the frequent and variable use of hysterectomy, there is need of continued judicious selection of method, with employment of safe surgical technic to minimize complications.

The indications for abdominal and vaginal hysterectomy, total or subtotal, will be considered here only briefly, and primarily as related to the technical operative aspects. The necessity of excision by either the preferred method or alte tive method are usually we

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discussions of the various abnormalities and diseases of the uterus and adnexae. In general, each case requires an individual appraisal; many factors must be considered in making a decision. The indications and significant factors are well described in many standard textbooks and publications.[3] Vaginal hysterectomy is often limited to patients with adequate vaginal and pelvic outlets and small or moderate-sized uteri, without any complicating adnexal and pelvic disease, so that further abdominal exploration is unnecessary. Again, it is often used for prolapse with cystocele and rectocele, and for benign tumors, such as small myomas, the "poor risk" patient with severe metrorrhagia, or the elderly or obese patient, when hysterectomy is required and abdominal procedures hazardous, may also profit by its use. For the surgeon especially adept and experienced in vaginal surgery there may be a much wider range of listed indications.[4]

Abdominal hysterectomy may be the preferred method for patients with one of the following benign conditions of the uterus or adnexae:[5]

1. Uterine fibroids requiring removal because of size, rapidity of growth, abnormal bleeding, pressure effects, or other sufficiently severe symptoms.
2. Pelvic inflammatory disease with marked and persistent symptoms and disability, unresponsive to adequate conservative therapy.
3. Endometriosis, when extensive and disabling in spite of hormonal and other treatment.
4. Myometrial hypertrophy and endometrial hyperplasia, especially if there is borderline neoplasia.
5. Rupture of the uterus.
6. Certain congenital defects with complications.
7. Hydatidiform mole.
8. Intractable hemorrhage apart from new growth and inflammation and unsatisfactorily controlled by more conservative methods.

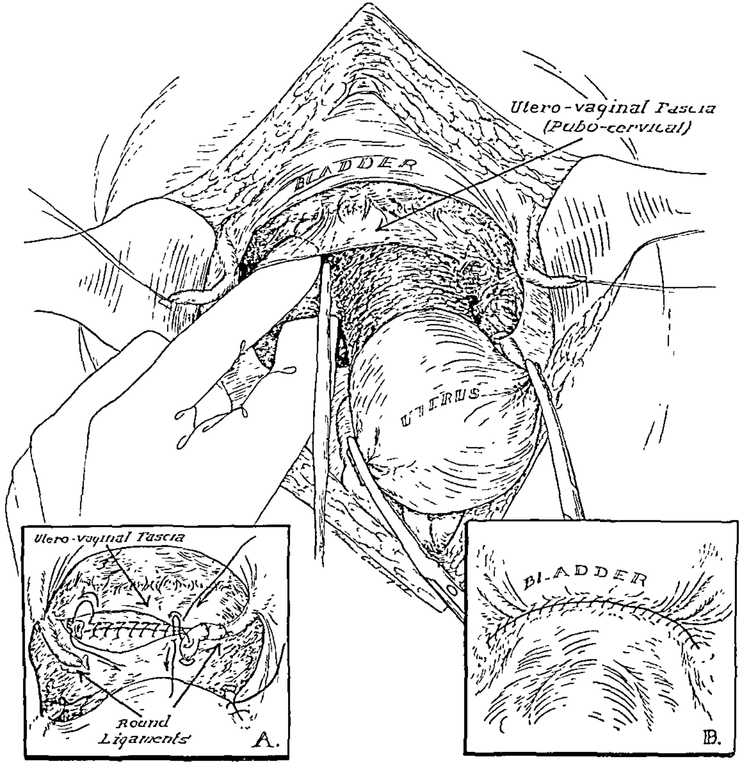
The operation may also be indicated as a prophylactic or reparative measure in some situations not involving uterine disease, after the uterus has fulfilled its reproductive function.

When hysterectomy is performed for malignant disease,[6] such as carcinoma of the ovary or oviducts, sarcoma of the uterus, carcinoma *in situ*, selected Stage I and II carcinoma of the cervix, and in some cases, far-advanced malignant growths with local extension to the rectum, bladder, etc., a more radical total hysterectomy, a radical Wertheim panhysterectomy, or a pelvic exenteration procedure[7] is performed, the choice being by the specific disease and the degree of its extension, as determined by observations on examination and at the time of operation.

*Total and Subtotal Hysterectomy.*—While there are certain indications and qualifying factors for each type of hysterectomy, marked variations, both conceptual and technical exist among surgeons, clinics and hospitals. Formerly supravaginal hysterectomy was the usual method of choice; recently many surgeons and clinics have placed total hysterectomy in this position.[8]

Supravaginal hysterectomy is often indicated in the presence of pathologic involvement of the paracervical and parametrial tissues. Total removal here may be both difficult and dangerous, as is exemplified by the "frozen pelvis" associated with gonorrheal infection or endometriosis. Too, it may wisely be used when hysterectomy is urgently needed; yet the operative time must be held to a minimum. It is also the operation of choice for the surgeon whose experience has been virtually confined to subtotal removal, or who has limited opportunity for training and experience with total hysterectomy.

Since the introduction of the Richardson method[9] and its modifications,[2b] conservative total hysterectomy can be performed almost routinely by a safe, anatomically and surgically sound method, with morbidity and mortality rates as low as those obtained with the subtotal method, and with the decided advantage of removing the cervix and thus obviating the dan-



App[illegible] cardinal ligament, within the anterior and posterior layers of the [illegible] vessels have been previously divided, ligated and allowed to [illegible] w closure of vaginal vault and reconstruction of supports.

ger of cervical carcinoma.

Indications and technical considerations connected with the more radical, cancer-eradicating, types of panhysterectomy with lymph node dissection,[10] and of pelvic exenteration,[7a] have been described and illustrated, with discussions of their present known results. These radical methods are still complex; the indications are not definite, and not enough is known of the quality of surgical performance and the effectiveness of the operation. Nevertheless they are very interesting operative approaches, showing a recent increase in application and popularity. They have also produced some important by-products in surgical knowledge and technic, by increasing the scope of the routine standard cancer-eradicating procedures and challenging the concepts and attitudes of the surgeon and the earlier methods of surgical treatment. Time, further experience and a careful evaluation will eventually yield a just appraisal of the merits of the more extensive procedures as applied to malignant lesions in the pelvis.

*Important Factors in Total Hysterectomy and Pelvic Procedures.*—Some of the important factors as they clarify and aid in the performance of a modified form of the Richardson method of total abdominal hysterectomy (as applied in benign uterine disease) and pelvic surgery, will be described giving a few generalizations followed by more detailed explanation and illustration of technic.

A. *Preparation of the Patient*: The usual preoperative preparation and orders are used, including, as indicated, proper antibiotic coverage, cleansing douches, and correctly typed and matched whole blood. In the operating suite, just prior to pelvic laparotomy, the vagina and cervix are adequately cleansed and prepared with Zephiran, and an indwelling urethral Foley catheter is inserted and left open to keep the bladder empty during the operation. This allows the surgeon a fully adequate operative field, with maximum visualization of the pelvic organs and the area of intervention.

The patient is placed in the usual supine position, so that the Trendelenburg position may be used after the abdomen has been opened. Intratracheal balanced anesthesia is the anesthetic of choice for all patients when this position and the packing off of the intestines are required to obtain the necessary exposure.

B. *Incision, Exposure, and Operative Problems*: Proper and adequate exposure is necessary here as in other sites and types of surgical intervention. An operation that may be somewhat difficult with either a poorly placed or an inadequate incision often becomes relatively easy when the incision is satisfactory. Equally important is the correct packing off of the abdominal contents away from the site of operation. This affords good visualization and facilitates the surgical procedure.

The type of incision depends primarily on the preference of the surgeon. A left paramedian incision, with the surgeon on the left side, if he is right-handed, is commonly used. This incision preserves at least 1 cm. of width of the medial leaf of the anterior and posterior rectus sheaths to permit easier and stronger closure of the incision later. When the Pfannenstiel incision is used it requires additional time in opening and closing, with a more limited exposure, but it produces a stronger postoperative incision and a less discernible scar. Whatever incision is utilized, it is important that the rectus muscles be split vertically in the midline down to the pubis. An inch (2.5 cm.) of extra exposure at the lower end of the incision is worth two at the upper end when one is working deep in the pelvis, just as the reverse is true of a high abdominal incision when one is working high in the epigastrium. Proper and adequate exposure of the pathologic area, providing the optimal conditions, is obviously always more important than the type, site and size of the incision.

Any adhesions of the bowels, omentum, etc., are carefully freed either from the pelvic structures or from under an old abdominal scar, if any is present, before the abdominal contents are packed off. The abdomen is also quickly examined with the exploratory hand to determine the presence or absence of any other abdominal disease. The freeing upward of any adhesions by a combination of sharp and blunt dissection in safe cleavage lines in the lower part of the abdomen and pelvis, before the routine steps of the hysterectomy are begun, permits better visualization of the pelvic organs, anatomic relations and pathologic processes; it also permits the surgeon to operate closer up in the incision instead of deep in the pelvis. As operation performed deep in an adherent pelvis is both more difficult and more dangerous, because of the increased liability to injury of important associated structures. When there is an increased danger of injuring any posterior structures, such as the ureters, the rectum or the great vessels, their positions and proximity to the site of the pathologic process should be determined by entering the extraperitoneal space, which facilitates any necessary exposure, freeing and separation of these structures from the diseased area. (The utilization of the extraperitoneal space for insuring a rapid, relatively avascular, and safe plane of dissection in abdominal and other regional operations is just beginning to be appreciated.) It is often helpful to enter this space when confronted with the "frozen pelvis" associated with gonorrheal infection, as well as in some cases of endometriosis, malignant tumor, adherent ovarian cysts or tubo-ovarian abscesses.

When the uterus and its appendages are freed of adhesions, the hysterectomy can usually be performed with the same routine clear-cut steps, almost irrespective of the size or nature of the lesion present. An understanding of the surgical anatomic background, as well as of the technic, makes hysterectomy possible with the use of a minimum number of correctly placed Kocker hemostats, especially if the vascular pedicles are ligated as the operation proceeds. Also, minimal bleeding and blood loss will occur if the uterus is held taut in the various necessary positions during its removal.

Although the relations of the bladder, the rectum, the vascular structures, etc., are important in pelvic surgical procedures and have an increased liability to injury in total hysterectomy because of their close proximity to the cervix, they do not seem to be as vulnerable as are the ureters. The seriousness of the complications resulting from unrecognized ureteral injury—renal damage, extravasation of urine, peritonitis, ureterovaginal fistula—stresses the importance of knowing their positions and the means of their protection throughout any major pelvic operation. This significance probably warrants some overemphasis, that attention may be directed toward preventing injuries and their serious complications.

The best method of avoiding injury to an important vulnerable structure is either to stay well away from it or to expose, palpate and visualize it, so that its relative position is known and can be protected throughout the operation. Failure to observe this simple, self-evident risk may make the difference between a poor and a successful result.

The position of the ureter should be routinely determined, therefore, in any pelvic operation in which the necessary surgical procedures might endanger it. It should not be "skeletonized" or individually isolated and separated from its bed if avoidable. If its further visualization and dissection are required, the periureteral adventitial tissue about it containing its blood supply should be carefully preserved. This is especially important in the more radical cancer operations, such as the Wertheim type of hysterectomy, combined abdominal-perineal resection of the rectum or partial pelvic exenteration procedures.

In total hysterectomy, protection of the ureter is especially necessary when one applies clamps to the infundibulopelvic ligament, the uterine vessels and the base of the broad (Cardinal) ligament. (22) These areas are the most vulnerable and are common sites of injury, the liability to injury increasing as the course of the ureter converges upon and approximates the bladder. However, the Richardson method of hysterectomy is specifically devised to avoid these dangers, and does so when it is properly executed—by keeping the operation 'under control', and avoiding excessive bleeding and soiling and also unnecessary or blind clamping.

C. *Technical Details of the Modified Richardson Total Hysterectomy:* The routine steps of performing total hysterectomy are begun by doubly clamping and dividing the round ligaments near the uterus. The Kocker clamps on the uterine side serve as the tenaculum to hold the uterus taut in various necessary positions as the operation progresses. The lateral portion of the ligament is dissected laterally for a short distance, then tied and tagged. This is the key step in opening the anterior and posterior leaves of the broad ligament and getting into the correct plane of cleavage and dissection. With tension on the lateral portion of the round ligament, the anterior leaf can be quickly separated in a relatively avascular cleavage line. The bladder is freed of the cervix anteriorly by a combination of sharp and dull dissection, the pressure of this dissection being concentrated on the uterovaginal ("pubocervical") fascia and the anterior portion of the cervix in a safe line of cleavage. This enables one to avoid injuring the bladder and obviates the subsequent danger of vesicovaginal fistula.

With the leaves of the broad ligament open and separated, the position of the ureter is readily palpated or visualized deep beneath the posterior leaf of the peritoneum.

The avascular space in the broad ligament is now easily opened. Clamps applied at this site are not placed too close to the side of the uterus, because of the troublesome bleeding that occurs if the uterine arteries are torn here. The infundibulopelvic ligaments containing the ovarian vessels are clamped, divided and securely ligated. In cases of benign uterine disease the adnexae are usually removed if pathologic, while one or both ovaries are conserved if the adnexae are normal. Adequate blood supply should be carefully preserved in an effort to decrease the tendency to postoperative atrophy or cystic degeneration of the retained ovarian tissue.

After the ureters have been accurately located, the uterine vessels are clamped, care being taken to protect the ureters as the clamps are applied. In cases of benign disease these clamps are applied relatively high on the uterine vessels, at the level of the internal os, which allows an adequate cuff with ample space for two secure ligatures placed well away from the ureter. There is no point in either clamping low or removing additional parametrial or paracervical tissue at this level, except in the presence of malignancy.

Adequate, safe hemostasis is of paramount importance. It is especially important when one is dealing with divided vessels or vascular pedicles of sufficient size or caliber to produce serious postoperative hemorrhage if not carefully and securely tied. Such vessels as the uterine, renal, splenic, gastric, pulmonary, large peripheral and others are of this type. They usually require two individual three-knot ties, with a safe margin of cuff distal to the ligatures. Ligatures are more secure when the pedicle is not held on tension when tied. Knots should be laid down flat, not as loops; one must be sure they "get home", but the vessel must not be cut. There is a definite danger if a large thin-walled or sclerotic vessel, is tied too close to either a closed or an insufficiently opened clamp. The anxiety over postoperative hypotension, an alarming postoperative state of shock, or worse, impresses one with the importance of safe hemostasis.

The uterus is drawn sharply up over the pubis, and the peritoneum and fascia on the posterior aspect of the cervix are divided transversely just above the uterosacral ligaments, and then separated distally by blunt and sharp dissection, with avoidance of injury to the rectum (Fig. 3). With the detachment of the uterosacral ligaments the uterus can be drawn nearer up into the incision, which decidedly facilitates the operation and eliminates the need of working deep in the pelvis.

With the bladder separated well down off the anterior portion of the cervix and the uterovagnial fascia—which is a collar-like deep layer of the endopelvic fascia—this anterior leaf of the uterovaginal ("pubocervical") fascia is divided transversely at or above the level of the ligated uterine vessels. A line of cleavage and dissection is developed beneath this fascial layer. This now constitutes and delineates the plane of the remaining dissection. Only the vaginal mucosa and base of the broad ligaments, laterally, now hold the cervix. With the surgeon's finger and thumb in this cleavage plane, within the anterior and posterior layers of the uterovaginal fascia, the lower end of the cervix and the remaining lateral tissue (cardinal ligaments) are easily palpated. By using the fingers to compress the ligament containing the vascular pedicle laterally, within this line of cleavage, the ligament may be safely clamped medially, without injury of the ureters and vascular structures in this important area (see illustration). The pedicle is tied off with a suture ligature, as illustrated, and the ligature is tagged for later use in tying this ligament into the corner sutures used in the vaginal closure.

The vagina is opened, either anteriorly or posteriorly, and divided. In cases of benign disease one hugs the cervix to preserve maximum vaginal length. This contrasts with radical hysterectomy for malignant disease, in which a wide vaginal cuff is removed with the cervix, as well as the paracervical and parametrial tissue.

A Zephiran-soaked sponge is pushed down into the vagina, to be removed at the completion of the operation. The vaginal mucosa is closed with a running-locking catgut suture; the valut is kept wide —not conical, which causes shortening. In closing the vagina and reconstructing the support of the vaginal vault, several important points warrant emphasis. The aim is to utilize the supporting detached ligaments, securing a closure with strong support and yet not injuring any of the vital structures that have been protected so carefully. All sutures used in the repair must be placed medial to the two tagged pedicles at the corners of the vagina (see illustration, inserts). No further dissection of the cardinal ligament is indicated or wise, because of the great danger of injuring the ureter and the uterine vessels. Anchoring of the pedicle of the cardinal ligament into the corner suture of the vagina, with closure of the anterior and posterior leaves of the uterovaginal fascia, reconstructs this important support.

The support is further accomplished by placing four or five No. 20 interrupted cotton sutures, picking up the uterosacral ligament with the posterior leaf of the fascia, a portion of the round ligament and the anterior leaf of the uterovaginal fascia, then tying them so that the round ligament remains viable, as illustrated.

The site of operation, together with all ligated pedicles and raw spots is now placed in an extraperitoneal position by closing the broad ligament peritoneum, using a fine atraumatic continuous catgut suture and carefully picking up and approximating the anterior and posterior leaves of the peritoneum, while one avoids the inclusion or injury of the ureter lying beneath the edge of the posterior leaf. If one or both ovaries are preserved they are anchored high, not down on the vaginal stump, because of the possibility of subsequent pain if they become adherent to the vault of the vagina. This fine-line peritonealization, with remaining raw areas reduced to a minimum, decreases the likelihood of adhesions, which have a well-known increased tendency to develop after a pelvic operation.

Before the abdominal incision is closed, the instillation of 300,000 units of aqueous penicillin and 1 Gm. of streptomycin is performed, and the omentum is brought down like an apron to lend additional protection to the operative site and the undersurface of the incision. This also decreases the possibility of postoperative intestinal obstruction occurring at these two common sites.

The incision is closed without drainage with cotton technic and reinforced with a few figure-of-eight retention wire sutures carried downward and including the anterior rectus sheath. The postoperative course is usually notable for its benignity, with no more complications than are noted after either supravaginal hysterectomy or any one of many simpler pelvic operations. Follow-up examinations have shown excellent results, with no evidence of vaginal discharge, shortening, dyspareunia or inadequate support.

In a recently studied series of 80 consecutive hysterectomies performed on the senior author's service during the past two and one-half years, there were 77 abdominal hysterectomies, all total except 9. Four of the total hysterectomies were of the radical Wertheim type, used in combination with high voltage roentgen therapy, for malignant disease. One of the patients who underwent a conservative supravaginal hysterectomy for fibroids returned a year later with a positive Papanicolau reaction and positive results from biopsy of the retained portion of the cervical canal, which, however, still appeared grossly normal. A very small carcinoma *in situ* was discovered just within the cervical canal after surgical removal of the cervix.

The indications for hysterectomy in this group of patients were: fibroids, 48 per cent; pelvic inflammatory disease, 16 per cent; endometriosis, 14 per cent; abnormal positions of the uterus with complicating factors, 8 per cent, and miscellaneous (including malignant tumors) 14 per cent. Benign disease was present in 95 per cent and malignant tumors in 5 per cent. Total hysterectomy was used in 88 per cent, and subtotal hysterectomy in 12 per cent. Vaginal hysterectomy was performed on 3 elderly patients with prolapse with accompanying cystocele and rectocele.

The aforementioned series of hysterectomies was accomplished without a significant postoperative complication and with a mortality rate of zero.

## SUMMARY

The advantages and technic of total abdominal hysterectomy are presented, with illustration and emphasis of certain important practical considerations used in performing this operation by the modified Richardson method.

Some of the usual general indications for hysterectomy, as performed by various methods, are listed, with a brief discussion of total and subtotal hysterectomy.

Total hysterectomy is the "operation of choice" when performed by a safe method.

Some recommendations and concepts are presented that aid in reducing the morbidity and mortality rates of pelvic surgery. A brief review is made of 80 consecutive hysterectomies performed during two and one-half years. There were no serious complications or deaths in this series of patients.

## RÉSUMÉ

As vantagens e a técnica da histerectomia abdominal total são apresentadas, com ilustrações e menção de certas considerações práticas importantes, usadas na realização desta operação pelo método de Richardson modificado.

São enumeradas algumas das indicações gerais, usuais, da histerectomia, realizadas de acôrdo com vários métodos, com uma breve discussão da histerectomia total e subtotal.

A histerectomia total é a "operação de escolha" quando realizada porum método seguro.

Algumas recomendações e conceitos que auxiliam a reduzir as médias de morbidade e mortalidade da cirurgia pélvica, são apresentados. Os autores apresentamuma breve revisão de 80 histerectomias consecutivas realizadas durante os últimos dois e meio anos. Não houve complicações sérias ou mortes nesta série de pacientes.

## ZUSAMMENFASSUNG

Die Technik der totalen abdominellen Gebärmutterresektion und die Vorzüge des Verfahrens werden dargestellt. Gewisse wichtige praktische Gesichtspunkte, die bei Ausführung der Operation nach der modifizierten Richardsonschen Methode eine Rolle spielen, werden erläutert und hervorgehoben.

Eine Reihe der gewöhnlichen allgemeinen Indikationen für die nach verschiedenen Methoden ausgeführten Gebärmutterresektionen wird mit kurzer Besprechung der totalen und subtotalen Hysterektomie aufgezählt.

Die totale Bebärmutterresektion ist, wenn sie mit Hilfe eines sicheren Verfahrens vorgenommen wird, die Operation der Wahl.

Es werden Vorschläge und Auffassungen unterbreitet, die zur Herabsetzung der Morbidität und Sterblichkeit bie der Chirurgie des kleinen Beckens beitragen sollen. Eine Serie von 80 unausgewählten Gebärmutterresektionen, die während der letzten zweieinhalb Jahre ausgeführt wurden, wird kurz analysiert. Es kam bei dieser Gruppe von Kranken zu keinerlei ernsten Komplikationen oder Todesfällen.

### RESUMEN

Se presentan las ventajas y técnica de la histerectomía abdominal total, con ilustraciones y énfasis sobre ciertas consideraciones prácticas importantes usadas en el desarrollo de esta operación por el método modificado de Richardson.

Algunas de las indicaciones generales de la histerectomía realizada por varios métodos, son enumeradas, con una breve discusión sobre histerectomía total y subtotal.

La histerectomía total es la operación de elección cuando se realize por un método seguro.

### RIASSUNTO

Viene descritta la tecnica, e i relativi vantaggi, dell'isterectomia totale per via addominale, secondo il metodo di Richardson modificato. Alcuni punti sono degni di interesse. Vengono elencate le indicazioni per l'isterectomia totale e subtotale, e i vari metodi. L'isterectomia totale è l'intervento di scelta quando eseguita con un metodo sicuro, e con gli accorgimenti necessari per ridurre la mortalità operatoria. Vengono presentati i risultati di 80 isterectomie eseguite in 2 anni e mezzo, senza complicaze nè morti operatorie.

### RÉSUMÉ

Les auteurs présentent les avantages et la méthode de l'hystérectomie abdominale totale modifiée de Richardson. Ils enumèrent les indications de l'hystérectomie totale et subtotale. Dans cet article l'auteur fait quelques recommandations qui aideront à réduire le taux de la mortalité. Il passe en revue 80 cas d'hystérectomie consécutives, pratiquées durant ces 30 derniers mois. Il n'a constaté ni complications sérieuses, ni décès.

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# A Method of Measuring the Length of the Bones

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IN present-day orthopedic surgery many occasions arise when it is of great importance to know the exact length of bones.

For the past thirty years leading orthopedic surgeons and radiologists have studied the subject of bone measurements. I have found the descriptions of numerous methods and technics many of which differed from one another only in minor details. None of the methods described has achieved popular acceptance.

Among the most important contributions to this subject are the works of H. Thomas,[1] who between 1922 and 1929 reported four different methods. Although his purpose was to measure the actual diameters of the pelvic inlet, his method was also used to measure the length of the long bones. First he measured the diameters of the pelvis by taking a roentgenogram with a pelvimeter placed on the patient. The ratio between the actual aperture of the pelvimeter and the distance, measured on the roentgenogram, gave him a proportion from which the different pelvic diameters could be calculated.[1a] Three years later he used a strip of lead with notches 1 cm. apart placed in the margin of the cassette.[1b] In 1929 he used a narrow strip of lead with perforations which were also 1 cm. apart, being placed this time in the center of the cassette.[1c] Two years later he proposed to take a first exposure on the patient and then a second exposure on a perforated plate of lead in which the perforations were placed 1 inch (2.5 cm.) apart.[1d]

These methods were similar to the "frame method" used as early as 1899 by Fabre and Fouchet (cited by Hirsch[2]), in which a frame with borders having teeth 1 inch apart was utilized.

Orthodiagrams, taken by moving the target along the contour of the bone and making a drawing of it on paper or unexposed film, were used in 1920 by Hareth and Grunkraut (cited byThomas[1a]).

Hickey[3] in 1924, Phemister[4] in 1933 and Moresh and Denning[5] in 1939 used teleroentgenographic procedures to measure the length of the long bones, using tube-film distances of 7 feet, 9 feet 2 inches and 5 feet, respectively.

Merrill[6] used a board with copper wires fastened tightly over pencil lines 1 inch (2.5 cm.) apart and having a second board screwed on top of it. In 1937 Millwee[7] reported his slit scanographic technic, using a slotted diaphragm on a tube driven lengthwise by a motor at various speeds. As the tube was moved from one end of the table to the other a beam of roentgen rays covered the patient. Four years before, Watson[7] also used a slit diaphragm, but instead of irradiating the whole length of the bone he exposed a small area at each end, the two images being recorded in the same film. For more accurate measurements he suspended a lead shot from the center of the tube. Its image in the picture marked the point from which the measurements were to be taken.

Gill[8] in 1944 modified the method of Millwee by substituting weights and pulleys for the motor that moved the tube, a less expensive method.

Also in 1944, White,[9] measured the results of epiphyseal arrests by using a standard tube distance with the feet pressing firmly against the footboard of the table. The difference in height of the femoral heads from the footboard was the difference in leg length.

All these methods failed to achieve popular acceptance because they did not fulfill

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certain essential requirements, as follows:

1. To determine with "mathematical" accuracy the actual length of the long bones.
2. To secure a simple method and one not requiring special or costly equipment.
3. To supply an easy means of "standardization" comparison of negatives taken in different places and by different technicians.
4. To secure uniform results.

With this in mind, I came to the conclusion that these requirements could be found in the method of similar triangles used by roentgenologists and obstetricians[10] in measuring cephalopelvic disproportions. It is accurate, as it is based on a proved geometric principle. It is simple, and the results in each case can be compared with others taken elsewhere, regardless of the differences in technics and in the position of the tube.

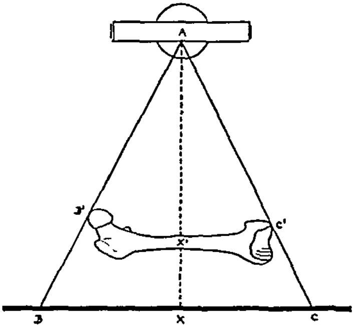
In reviewing the literature I observed that the earliest report of this method was presented by Allen[10] who, in 1916, used the principle of similar triangles to measure in roentgen films the actual pelvic diameters of pregnant women.

Triangulation methods were used also by Levy and Thumin (cited by Hirsch[2]).

*Rationale.*—Before exposing the film, I consider two imaginary triangles formed by the roentgen tube in their common apex, the length of the bone in the film and the actual length of the bone in the sides opposite the apex (see illustration)*.

In these triangles one knows the distance *BC* as it can be measured in the film.

The sides *AB* and *AB′*, although not exact, for practical purposes can be taken as the distance measured from the roentgen tube to a horizontal plane at the level of the film (*AX*) and to the one at the level of the bone (*AX′*).



Triangulation method (see text for explanation).

One can therefore say:

$AB' = AX'$ = distance from the roentgen tube to the plane of the bone.

$AB = AX$ = distance from the roentgen tube to the plane of the film.

$BC$ = length of the bones as measured in the film.

$B'C'$ = actual length of the bone (unknown).

By geometric reasoning one knows that:

$$\frac{AB}{A'B'} = \frac{AB}{BC}$$

$$B'C' = \frac{AB' \times BC}{AB}$$

Occasionally, when the patient is extremely obese, it may be difficult to determine the exact distance from the target to the bone to be examined. In such a case it may be possible to obtain the exact measurements by using the method of Mackenzie-Davidson for locating areas within the human body by moving the roentgen tube a certain distance on both sides and taking two consecutive exposures in the same film, as proposed by Van Allen.[1] This difficulty in locating the bone, however, is rare.

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*Length of bone $= \dfrac{\text{(distance from roentgen ray to bone)} \times \text{(length of bone in film)}}{\text{distance from roentgen tube to film}}$

Example:

Distance from roentgen tube to film = 100 cm.

Distance from roentgen tube to bone = 90 cm.

Length of bone in film = 30 cm.

Actual length of bone $= \frac{90 \times 30}{100}$ = 27 cm.

Experience has shown that taking the measurements in centimeters makes the calculations a great deal easier.

*Technic.*—Place the patient under the roentgen tube. Measure the distance from the target to the film. Measure also the distance from the roentgen tube to the bone.

Localization of the bone plane can be made by direct palpation in most cases or, in very special cases, by the method of Mackenzie and Davidson. These factors and the measurement of the bone in the film are all one needs to calculate the exact length of the bone.

If a cassette large enough to take a roentgenogram of the whole bone is not available, as may be the case when one is dealing with the bone of an adult, the distortional enlargement can be minimized by increasing the distance from the target to the bone.

To accomplish this, I place the patient on a stretcher on the floor and raise the target as far as possible. In reviewing the literature I have noted that Hickey used this same procedure in similar instances.

The advantages are (1) it is exact; (2) it is simple; (3) it provides uniform results for comparison, and (4) it enables one to avoid the personal factor in reading the negatives.

It is mathematically accurate and exact. It merely requires the technician who takes the picture to record the distance from the roentgen tube to the film and to the bone. The radiologist, with this information, measures the bone in the film and proceeds with the calculations. It could be said at first glimpse that the calculations are too complicated, but the same calculations are made every day without difficulty by the roentgenologist in measuring the pelvic inlets of pregnant women.

The results will be uniform, since they will not be influenced by changing distances from the tube to the part to be examined. Consequently, the comparison of negatives taken in different institutions with different technics will be feasible. This is of the utmost importance, as the method has its greatest use in children; families frequently change their addresses, or changing age periods cause transfer from one institution to another.

Since the method is based strictly on mathematical calculations, the personal factor, with its unavoidable margin of error in reading the negatives, is completely eliminated, and the results registered in the clinical history of the patient can be compared with later ones despite the lapse of time between the two examinations.

*Indications.*—This method is indicated in measuring (1) the growth of bones in normal and paralyzed extremities or after epiphyseal arrest following injury; (2) the growth of bones after surgical closure of the epiphysis, and (3) the growth of bones after epiphysial stimulation. It is also useful in the selection of a nail of the correct length, eliminating the trial and error so frequent in intramedullary fixations of fractures. (In cases of fracture, the picture should be taken of the opposite side to eliminate unnecessary handling of the fractured bone). Also, in using a Hanson-Street type of nail for femoral fixation, it is important to know the diameter of the medullary canal in its narrowest portion (isthmus). These measurements can be easily obtained by the proposed method.

## SUMMARY

1. A method used previously in obstetrics and based on an old geometric principle is adapted to Orthopedics so that the length and growth of the bones can be accurately diagnosed.

2. The technic, advantages and indications are outlined.
3. A review of the literature dealing with the subject is presented.

### ZUSAMMENFASSUNG

Eine auf alten geometrischen Grundsätzen beruhende und früher in der Geburtshilfe angewandte Methode wird den Anforderungen der Orthopädie zur genauen Messung der Länge und des Wachstums der Knochen angepasst. Die Technik, die Vorteile des Verfahrens und seine Indikationen werden angegeben. Ferner liegt ein Überblick über das einschlägige Schrifttum vor.

### RESUMEN

Un método previamente usado en obstetricia y basado en un viejo principio geométrico se adapta a la ortopedia de manera que la longitud crecimiento de los huesos puede medirse con exactitud. Se delinean la técnica, ventajas e indicaciones. Se presenta una revisión de la literatura sobre el tema.

### RIASSUNTO

Si tratta di un metodo basato su un vecchio principio geometrico, e usato da tempo in ostetricia. Vengono descritte tecnica, vantaggi e applicazioni di esso in ortopedia.

### SUMARIO

Um método usado prèviamente em obstetrícia e baseado num antigo principio geométrico é adaptado à ortopedia de maneira que o comprimento e o crescimento dos ossos possam ser exatamente medidos. A técnica, vantagens e indicações são esboçadas. Uma revisão da literatura sôbre o assunto é apresentada.

### RÉSUMÉ

Une méthode utilisée auparavant en obstétrique et basée sur un vieux principe de géométrie est appliquée à l'orthopédie pour mesurer la longueur et la grosseur exactes des os. L'auteur en indique la technique, les avantages, les indications et présente une revue de la littérature sur ce sujet.

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# Section on Ophthalmology and Otorhinolaryngology

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# Solo Technic in Ophthalmic Surgery

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POSSIBLY the most interesting, and aesthetically perfect operation, and also the one that provides the most gratifying result all around, is the extraction of a lens from the human eye. Many and varied have been the writings on this absorbing subject since the days of Susruta[1], and much aqueous has flowed in human eyes since the first lens was extracted by Jacques Daviel at some time in the first half of the eighteenth century. To dwell upon the subject of modern technic in the surgical treatment of cataract would be mainly a repetition of well-known facts. Satiation is yet far off, however, and it is almost impossible to check the desire to offer one's mite!

In India, as perhaps nowhere else, cataract operations are performed with a gusto and abundance till fantastic figures of 100,000 and over have been reached by individuals to whom ophthalmologic surgery means nothing more than cataract extractions. This is true for some. The ophthalmologic world, however, wonders about this mass surgery and has almost come to believe that an average Indian ophthalmologist begins his day with a possible 100 cataract operations before breakfast! This, however, is only imagination run wild. India is such a vast and heavily populated country and the specialists comparatively so few that the quota of eye patients coming to each ophthalmologist was remarkable. Nowadays, owing to organized ambulant eye camps, mobile ophthalmic units, the opening of new hospitals and the training of more specialists, this remarkable individual quota is fast dwindling.

To observe an ophthalmic surgeon in any of the hospitals or private clinics in India nothwithstanding the heavy schedule of work, one is impressed with the meticulous details of modern surgical skill and equipment at the command of the surgeon.

When I started in ophthalmic practice some thirteen years back, I had my new Graefe knife and iris scissors. I got the rest of the instruments at second hand. But there was one second hand I did not get—an assistant to help me in my operations. The fact is, I could not afford one then. So I started doing my operations alone and have never regretted the fact. At first, when I finally got an hospital assignment and was entitled to an assistant, I thought it luxury; but in a very short time I decided that self-help was best and that the well-meaning and respectful person at my elbow was supernumerary and (I am sorry to say it) a distraction. Since then I have asked for an assistant only when doing an orbitotomy or an extenteration. I do not know whether there are any other surgeons of my opinion, but I

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do know that almost all whom I know and have seen operating at home and abroad, in Europe and the United States—invariably have assistants to help them. I do not doubt the advantages of a good assistant, but one knows that even the widened palpabral fissure can hardly accommodate ten fingers. Then there is the risk that the other chap's attention may wander, perhaps right in the midst of a critical stage of the operation thinking possibly of his "dates" or something else irrelevant and inadvertently causing the vitreous to pop out by unconscious pressure with his thumb or finger upon the open eye of the patient. One must, however, make allowances for him, since all the monotony of the watching is on him day in and day out.

Not because I can not afford to have one now, not because I treat the role of an assistant lightly, and not because I have any phobia with regard to assistants, I operate solo. But because I have learned the technic and secret of being a surgeon and his assistant at one and the same time, and prefer it so, because I feel that if anything should go wrong I alone would be to blame and need not curse my patient or the assistant, and because I know that the less meddling and fussing that takes place near or in the eye the better for the organ, I operate solo. With due respect to assistants and without offense to any, I am convinced that an ophthalmic surgeon does not need an assistant in any intraocular or extraocular surgical procedure except an orbitotomy, an exenteration, or perhaps in extensive separation of the retina.

I shall now describe in some detail my solo technic for an intraocular operation, namely, a lens extraction that includes a modified conjunctivosclerocorneal suture and its postoperative removal. The whole operation, from beginning to end, is performed without the aid of any assistant.

The patient is admitted one day prior to the day of operation. The routine laboratory investigations are carried out as usual. I do not take culture swabs from the conjunctival sac. The lacrimal apparatus is not interfered with in the absence of regurgitation on pressure upon the lacrymal sac. The eyelashes are clipped, and drops of 4 per cent mercurochrome solution are instilled in both eyes, followed by application of 1 per cent aureomycin ointment. The eye to be operated upon is padded and bandaged. This treatment is repeated every six hours. If the bowels have been regular, I do not believe in upsetting them with either an enema or a purge. Seconal sodium, 1½ gr., is given at night. I need not dilate upon the routine general checkups and treatment of any abnormality observed in any system, as this is done conventionally everywhere. Penicillin is given only when indicated. Next morning the patient's face is washed with warm water and soap. One per cent atropine sulfate solution, in drops, is put into the eye to be operated on before it is anesthetised with 1 per cent pantocaine with epinephrine. Seconal sodium, 1½ gr., is again given half an hour before the operation.

The conjunctival sac is irrigated with sterile water at room temperature, after instillation of drops of 20 per cent solution of argyrol in the eye. The whole face is then scrubbed thoroughly with gauze swabs wrung out of petrol,[2] until the last swab is free from dirt and grease. The hair line from ear to ear and over the forehead is dabbed with tincture of benzoin co., or with flex. collodium, to fix the loose strands of hair, preventing them from straggling into the field of operation. All this is done by a nurse. The surgeon, after thoroughly scrubbing his hands with soap and water, dries them on a sterile towel and then rubs briskly his forearms and hands, from elbows to fingertips and between the webs, with a 4 x 4 gauze piece dripping with petrol and then dries them. I do not use gloves. The patient's head is then draped in the following manner step by step.

The patient is asked to lift his head from the table, and a sterile towel is spread under it. Then a square towel is folded diagonally into a triangle; the hypotenuse is caught at both ends, and the edge is placed over the forehead, covering the eyebrows. The ends are brought one by one under the head, partially covering the ears, the right end coming over to the left side, and the other *vice versa.* The third middle end is tucked simultaneously under the head. The whole towel is thus kept tight and in place by the weight of the head.

Facial block by O'Brien's method is given, being induced with 10 cc. of 2 per cent procaine hydrochloride solution to which have been added 100 TRU of Hyalase, (a brand of hyaluronidase) and 2 drops of epinephrine in 1:1,000 solution. Then another sterile towel is spread over the chest, the upper edge covering the upper lips and keeping the nostrils at the same time well ventilated, and the ends covering the lower half of the ears. One towel clip is applied at either side, fixing the two towels together. A retrobulbar injection is given from the inferotemporal angle of the orbit through the skin, using 2 cc. of 4 per cent procaine hydrochloride solution to which have been added 2 drops of epinephrine chloride solution, 1:1,000, and 100 TRU of hyaluronidase. A 2 by 2 piece of gauze wet with physiologic solution of sodium chloride is placed over the closed good eye. Then another towel, with a square or rectangular hole, is placed over the head, exposing the ipsilateral side of the nose and the eye to be operated upon. A superior rectus bridle suture is applied and a speculum inserted, after which the superior rectus suture is clamped to the head towels with a hemostat, after the eye has been brought down as far as possible by manipulating the superior rectus suture. The conjunctiva is then wiped clean with a cotton swab which has been made up into a thin spindle with two tapering ends and wrung out of physiologic solution of sodium chloride. An external canthotomy is done in nearly all cases. A semicircular limbus-based conjunctival flap 3 mm. wide is prepared and reflected over the cornea, which is wet every few seconds with drops of the saline solution. The upper part of the cut conjunctiva recedes upward toward the superior rectus, owing to the pull of the bridle suture. The limbus is then freed of the conjunctival and subconjunctival tissues to the very edge of the cornea, all around the upper half, from the under side of the limbus-based flap, with a Bard-Parker No. 15 knife blade. I use a new blade for each operation. Then the cornea is split at the 12 o'clock position into anterior and posterior layers, to about 1 mm. This may be called making a groove for the McLean suture. All the bleeding points are sealed with a Wordsworth cautery heated over a spirit lamp. To save time, two such cauteries are used. The nurse heats one held with a sterile instrument forceps and hands it to the surgeon when ready, and he uses it while the other is being heated. (It is not to be inferred that the nurse in any way is assisting actively in the actual operation!)

The next step is to insert a preplaced suture, which is a modified McLean one. This I shall describe a little more fully, because it is included in my "mite" along with the solo surgical technique. I use exclusively a 7 mm. rustproof Grieshaber corneal needle and 6/0 surgical black silk with either a Stallard or a Kalt needle holder. The needle is passed through the upper border of the cut conjunctiva exactly opposite the position of the split cornea. The needle then is passed through the sclera at the limbus, at the site of the split, and brought out, and then passed through the anterior lip of the split cornea. The loop of silk is picked up with a Grieshaber corneal suture forceps or an iris hook and laid aside on the temporal side. Another needle is threaded with the suture thread that remains over the upper cut conjunctiva.

At this point one might need an assistant to fix the eyeball for placing the suture, but I have with me, already, not one but four assistants, infallible, unobtrusive, reliable and faithful to the last. They are: (1) hyaluronidase; (2) retrobulbar injection which has paralyzed the extraocular muscles and inactivated the ciliary ganglion; (3) a superior rectus suture, and (4) my fingers. These have never let me down yet. The technic of the retrobulbar injection must be perfect or else one is stranded sometimes in the middle of the operation, especially when the eyeball has been opened. It is possible that there still may remain some motility of the bulbus after the retrobulbar injection. Then, if one feels the need of absolute immobility, another injection with the same amount and constituents of the same solution may be given through the conjunctiva at the infertemporal corner of the orbital base, without any harm whatsoever and with full benefit. As for the use of Hyalase (hyaluronidase) and the retrobulbar injection technic, I would refer to a former publication.[3] The eyeball, I must emphasize, is totally immobile after the first retrobulbar injection in 99 cases out of 100. The superior rectus suture keeps the eye down in a most convenient position, and there is absolutely no need for fixation of the eyeball during the placing of the suture. The sharp needle passes through the sclera and cornea most easily, almost too easily. Proper alignment of the scleral edge and the corneal section is obtained by holding the anterior lip of the split cornea with a straight conjunctival forceps or with Grieshaber's corneal forceps when one is passing the needle through the cornea.

Next, a keratome is passed into the anterior chamber from the 10 o'clock position, whether the right eye or the left is operated upon. Here, fixation of the eyeball is done with the left hand, with a fixation forceps at the 6 o'clock position. I use a Lister's conjunctival sutures forceps for the purpose. After the chamber has been entered, the keratome is withdrawn very slowly and the corneal incision enlarged with corneal scissors or Westcott scissors. I usually enlarge it to a little more than half the circumference of the cornea. The manipulation can be adjusted to satisfaction and with ease by using a plain conjunctival forceps, which holds the cut conjunctival flap and guides the scissors.

As the scissors come near the site of the preplaced suture, the forceps in the left hand picks up the thread, together with the anterior lip of the split cornea, and retracts it aside while the scissors cut the limbus at that place. This totally prevents accidental severing of the preplaced suture during the corneal section. A peripheral buttonhole iridectomy is performed at the 12 o'clock position. Here also no fixation by an assistant is necessary. The eyeball is immobile and one must lose the fear of any movement of the eye which might result in a total tearing out of the iris. Any bleeding that might occur after the iridectomy can be washed off and checked by an irrigation with a Dougherty's blue glass-tipped cannula attached to a rubber bulb containing physiologic solution of sodium chloride, to which may be added a few drops of epinephrine chloride in 1:1,000 solution.

The suspensory ligaments are then broken by the tip of a tenotomy hook applied over the lower arc of the cornea. It is important to note that the tip must traverse to and fro *on the cornea itself*, and its excursions are limited up to the limbus. The amount of pressure exerted by and through the tip of the hook can never be satisfactorily assessed. That sense is an integral part of the experience of the surgeon, and he is the sole judge of its application. This pressure, which is exerted in such a way that the lens is pushed a little upward, is given support by the superior rectus suture, which pulls the eye downwards with a constant and uniform pull. It is a notable fact that the dilated pupil contracts as soon as the aqueous drains out after a corneal section, in spite of the previous atropine and epinephrine instillations and the retrobulbar[4] injection. The tip of the hook, therefore, is manipulated in such a way that it begins its excursions on the corneal surface from above downward from several points on the lower margin of the pupil, thus dilating it as the tip goes downward towards the limbus. This makes the paralyzed sphincter more stretchable during the subsequent delivery of the lens.

The superior rectus suture clamp is released at this stage and the eye speculum removed, after which the former is reclamped at the original site, with care not to stretch the silk thread. The upper lid is adequately retracted. The lower lid usually comes up to the level of the lower limbus after removal of the eyelid speculum. Removal of the latter takes away the additional or, to be exact, the only pressure on the eyeball. As a matter of fact in almost all cases, on removal of the speculum a central dimpling of the cornea is observed, due to collapse of the anterior chamber and the negative pressure created by the retrobulbar injection and hyaluronidase.[5] The anterior chamber may be restored by injecting saline solution into it through the irrigator.

Now it is the surgeon's choice to use either a capsule forceps or an erisiphake. I use the latter when the lens is in a hypermature cataractous stage or is intumescent with a tightly stretched capsule. The conjunctival flap is caught at the 12 o'clock position with a straight conjunctival forceps and lifted up, the cornea being lifted to allow the erisiphake to be introduced into the chamber. The erisiphake is then placed on the lens through the pupil, as low as possible. The same is done when a forceps is used. I use a Bell erisiphake and an Arruga capsule forceps. The chief trick is to catch the capsule at the 6 o'clock position as low as possible and lift the lower pole up and then gently break the few remaining zonular fibers by counterpressure with the straight conjunctival forceps on the cornea, not on the limbus or the sclera. This forceps is held in the left hand between the thumb and the index finger, supported by the middle finger, while the ring finger of the same hand pulls the lower lid down by applying a pull on the inferior orbital rim. The lens simply comes up easily rotating as it does on the hyaloid face of the vitreous with a central fulcrum. It is as easily lifted up and coaxed out. This prevents any rupture of the hyaloid face of the vitreous, which, as a matter of fact, owing to the negative pressure in the vitreous, can be seen at a much lower level than usual behind the plane of the iris, after the delivery of the lens, when illuminated obliquely. (Here, as the patient is lying supine, the iris plane instead of being considered anterior, is superior.) The whole lens is thus delivered intact intracapsularly, with a round pupil. There is no hurry[6] or flurry to close the wound, since nothing extraordinary is going to happen. The using of the special Castroviejo knot[7] in the central preplaced suture would seem superfluous. The eye is quiet and immobile; the patient is snoring peacefully under the barbiturate, and the orbicularis is fully paralyzed. The iris is gently reposited and the pupil brought into the center from all sides. Since a sort of concavity is produced by the absence of the lens and the low intraocular pressure, I find the pupil repositor of Dastoor[8] invaluable. The two prongs of the narrow spatula really replace the pupil and the iris remarkably well in the position desired.

The limbal flap of the conjunctiva is then cut vertically exactly over the suture at the 12 o'clock position, up to the limbus, and thus two separate segments of the limbal conjunctival flap are produced. The conjunctivosclerocorneal suture is then tied with a surgeon's knot. The superior rectus suture clamp here must be momentarily released to allow the conjunctiva from the upper fornix to come down in apposition near the limbus. Actually the upper conjunctiva is brought down, by the tightening of the suture to the cornea, as a triangle. It fits exactly and accurately in the triangular gap produced by the vertical section of the limbal conjunctival flap at the 12 o'clock position. The knot is then tied. The two ends of the tied suture now have each a needle. With each of them the conjunctiva is sutured with a running stitch on either side of the central conjunctivosclerocorneal suture.

It should be mentioned that, as soon as the lens has been delivered, the cornea is wet with a drop of 4 per cent pilocarpine solution[1] instead of with saline. On an average these drops are instilled three times after the lens delivery and before the completion of the operation. The patient leaves the table with a small pupil.

With the irrigator now emptied of all solution, an air bubble is introduced into the anterior chamber with the glass-tipped cannula. The external canthotomy is repaired. The superior rectus suture is cut, and aureomycin ointment is applied on the upper lid border, which is lifted up with a forceps and gently reposited over the eyeball. The ointment serves the double purpose of supplying a potent antibiotic and temporarily gluing the upper and lower lids together till the orbicularis functions again. The advantage of the ciliary block is evident from the loss of sensation in the skin of the eyelids. The canthotomy and its repair need no additional anesthesia. Sterile pads are put over both eyes, and a metal eyeshield is placed over the pad on the surgically treated eye. A double eye bandage is applied, and a wire gauze guard is applied over the bandage for additional safety.

It is not necessary to describe the postoperative dressings and treatment. The sutures are normally removed on the eleventh postoperative day, when the eye is anesthetized with drops of 1 per cent pantocaine. The patient sits comfortably in a chair or lies supine on a table, with the head tilted well back. The surgeon stands facing the patient, with a good diffused light falling on the eye of the latter. With a straight plain conjunctival forceps held with the left thumb and the index and middle fingers he gently lifts up the central conjunctivosclerocorneal suture. The left ring finger retracts the upper eyelid. The patient looks down. Next, with a slightly curved and very fine-pointed scissors, the suture is cut over the cornea; then the forceps in the left hand lifts up the cut suture with a slight pull, which draws up the conjunctival running sutures from around both sides of the cornea. The ease with which the sutures can be removed with one snip of the scissors is noteworthy. Here also there is no need for an assistant.

## COMMENT

I have given this cataract extraction technic in some detail, underlining, as it were, the unfailing reliability of hyaluronidase, retrobulbar injection, facial block and the surgeon's fingers, which can be trained to do the exact work of the surgeon himself and that of his assistant at the precise and required moment. I have explained my solo surgical technic through a lens extraction operation, but, believe me, it is not the only operation that can be done solo; all the other intraocular and extraocular operations can be easily and *safely* performed in the same manner. Whenever tissue forceps are applied in plastic repair or hemostats carrying certain traction sutures are used, they can be easily, and without altering the original position, held in constant place by using towel clips attaching them through the fingerholes of the tissue forceps or the hemostats, to appropriate drapings around the field of operation.

Time? It does take a little longer than when an assistant is present. But what are a few minutes more when such a delicate organ is being manipulated? The comparative ease and freedom, the latitude to arrange everything in one's own fashion and to one's own liking without any annoying disturbance or presence in the operative field, is worth far more than the ordinary advantage of extra help, which at the best, though well meant and conscientious, is after all heterogenous, incoordinate and comparatively slow, because two different brains are issuing orders.

I am fully conscious of my vulnerable position and of the avalanche of criticism that is certain to descend upon my solo surgical technic. Whatever may be the consensus among experts and veterans, however, I am fully satisfied with it and so have been, and are, my patients. My only plea is that the skeptic will try out this method in a certain number of cases, and then pass his verdict. This method will appeal especially to those surgeons who are stationed in inaccessible places where the luxury of a trained assistant is miles away. Perhaps this may answer Rothberg's question[9] of an assistant in ophthalmic surgery. It may also appeal to those starting in their careers who must take the budget seriously into account.

## SUMMARY

A technic of ophthalmic surgery without an assistant's help is described. The details of an intra-ocular operation, a lens extraction, and the author's personal technic are given to illustrate the new method. A new modified conjunctivosclerocorneal suture is described, together with the method of its postoperative removal.

The author stresses his opinion that all intraocular and extraocular operations should be done by the surgeon without the help of an assistant except perhaps in cases of an orbitotomy, an exenteration or a time-consuming retinopexy. The advantages of this solo technic and the disadvantages of using an assistant in eye operations are mentioned.

## RIASSUNTO

Viene descritta la tecnica per la chirurgia oculare senza assistenza, con i dettagli per un nuovo tipo di intervento intraoculare di estrazione del cristallino. Viene descritta inoltre una tecnica di sutura congiuntiva-sclero-corneale. L'autore è d'avviso che tutti gli interventi nell'occhio si possano fare senza aiuto, tranne la orbitotomie, l'exanterazio e la retinopessi, con grande vantaggio.

## RESUMEN

Se describe una técnica de cirugía oftálmica sin la ayuda de un ayudante. Para ilustrar el nuevo método y la técnica personal del autor se dan los detalles de una operación intraocular, la extracción del cristalino. Se describe una nueva sutura conjuntivoesclerocorneal, junto con el método de su remoción postoperatoria.

El autor hace notar que todas las operaciones intra y entraoculares deben hacerse por el cirujano sin ayudante, exceptuando quizás la orbitotomía, la exenteración y la retinopexia. Se mencionan las ventajas de esta técnica y las desventajas de un ayudante en las operaciones oculares.

## ZUSAMMENFASSUNG

Es wird eine augenchirurgische Technik, die keine Hilfe eines Assistenten erfordert, beschrieben. Zur Erläuterung dieser neuen Method wird ein intraokulärer Eingriff, namlich eine Linsenextraktion, und die persönliche Technik des Verfassers im einzelnen geschildert. Ferner wird eine neue modifizierte konjunktivosklerokorneale Naht und das Verfahren ihrer postoperativen Entfernung beschrieben.

Der Verfasser betont, dass alle intra- und extraokulare Operationen vom Chirurgen allein ohne Assistentenhilfe ausgeführt werden sollten mit Ausnahme vielleicht von Fällen, wo eine Orbitotomie, eine Ausräumung des Augapfels oder eine zeitraubende Netzhautfixierung in Frage kommt. Die Vorteile dieser Einzeltechnik und die mit dem Hinzutreten eines Assistenten verbundenen Nachteile bei Augenoperationen werden erwähnt.

## RÉSUMÉ

Description d'une technique de chirurgie ophtalmique sans assistant. La nouvelle méthode est illustrée par les détails d'une opération intra-oculaire, par la description d'une extraction du cristallin et par la technique personnelle de l'auteur. Il décrit une suture conjonctivo-scléro-cornéenne modifiée e indique la méthode de sa suppression.

L'auteur isiste sur le fait que toutes les opérations intra-et extra-oulaires devraient être faites sans l'aide d'un assistant, sauf peut-être en cas d'orbitotomie, d'éviscération ou decétinopexie. Il mentionne les avantages de cette technique sans assistant, et les désavantages de l'opération avec assistant.

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There is no tyranny so hateful as a vulgar and anonymous tyranny. It is all-permeating, all thwarting; it blasts every budding novelty and sprig of genius with its omnipresent and fierce stupidity. Such a headless people has the mind of a worm and the claws of a dragon. Anyone would be a hero who should quell the monster.

Society is like the air, necessary to breathe, but insufficient to live on.

Why should not things be largely absurd, futile and transitory? They are so, and we are so, and they and we go very well together.

—*Santayana*

# Editorials

## An Evaluation of the Surgical Approach to the Duodenal Ulcer Problem

MY evaluation of the surgical approach to the care of duodenal ulcer is just another man's opinion on a perplexing problem.

In my own judgment, which is borne out by most of the literature I have reviewed, partial gastric resection embracing three-fourths of the stomach tissue and, if possible, the duodenal ulcer itself is still the operation that provides the greatest amount of relief in the majority of cases.

There are so many variable factors in the problem of duodenal ulcer that one should hesitate to make a didactic statement as to the "best" operation. Each case should be evaluated individually. Therefore, I use the term "majority" in the foregoing conclusion.

There is no "best" operation for this disease, which, after all, is physiopathologic and is not actually a surgical disease. Surgeons operate for the complications of ulcer and not the ulcer itself.

The physician who advises a patient with ulcer to seek surgical cure of his complication should be sure that the patient understands that he is to lose a portion of his intestinal tract and not to have a new one installed with a guarantee that it will be trouble-proof. The patient's personality pattern and his ability to accept certain restrictions have much to do with his response to the surgical procedure. Indeed, this element has much to do with response to surgical treatment whether the stomach is concerned or not. I call it the quality of adaptability to circumstance. It makes either "good" or "bad" patients, whether treatment is medical or surgical.

Sex, age and even the country of birth of the patient influence the course of treatment.

Heredity must be another factor in the rate of recurrence following any procedure for cure of ulcer. Bauer and Aschner[1] reported that peptic ulcer is four times as common in the families of ulcer patients as in control families. These patients, then, because of predisposing biologic inferiority of the stomach and duodenum inherited as a Mendelian recessive characteristic, would logically show a higher percentage of poor results.

In my own experience the economic status of the patient seems to influence the type of complication. Among patients at the Kansas City General Hospital free perforation of the duodenal ulcer is by far more common than among those in my private practice, in whom bleeding and posterior penetration seem to be the most frequent complications. Certainly psychic factors can have little to do with this, but the private patient has probably had better medical and nutritional care, and his ulcer has progressed more slowly.

Neurohumeral and psychic factors play a large part in peptic ulcer in human beings, and surgeons often minimize these factors. Each patient with duodenal ulcer presented for surgical intervention, particularly those with "intractable pain," should be studied for these factors, and previous efforts to control the symptoms should be subjected to careful evaluation. Surgeons pay too little attention to these factors in the preoperative and postoperative care of patients. To offer surgical measures as a cure to a patient who has been careless in or resentful of the proper medical regimen for his ulcer is certain to increase the surgeon's percentage of poor results.

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[1] Bauer, S., and Aschner, B.: Peptic Ulcer, Am. Gastroenterol. Soc. (Sandweiss) 1951, p. 146.

The mortality rate following various surgical procedures depends on the skill of the surgeon, and morbidity figures also depend in large part on this technical skill, but the final classification of a result as good, fair or poor depends also on psychogenic factors and how they are handled by the surgeon, the attending physician and the patient.

Sandweiss,[2] Cotui and others have stated that the incidence of peptic ulcer is low among psychotic persons, and it is also known that a large percentage of these have hypochlorhydria and considerable tolerance to histamine. (Electroconvulsive shock and insulin shock therapy increase release of histamine in the patient.) There is proof that adrenocortical hormones are antagonistic to histamine, so that it may be reasonable to assume that overactivity of adrenocorticoids may cause a psychotic disorder such as schizophrenia, a decrease in the release of histamine and resultant hypochlorhydria. Underactivity of adrenocorticoids may cause psychosomatic disorders, an increase in the release of histamine and resultant hyperchlorhydria and duodenal ulcer. The implication is, of course, that to escape ulcer it is not necessary to be psychotic but that it helps!

Peptic ulcer is often associated with hyperthyroidism. This is a clinical fact that the elder Crile[3] noted in 1932, when he stated that the background of peptic ulcer and test of hyperthyroidism are identical. Later, he stated that peptic ulcer was a "kinetic disease" due to physiologic disease of the "energy system," and offered bilateral adrenal denervation as a cure for peptic ulcer.[4] Complete denervation of the adrenal glands has since been proved anatomically infeasible.

The common background of stress and strain in duodenal ulcer, hyperthyroidism and adrenal dysfunction is now well recognized. Also, the exacerbations of some diseases of the collagen, such as rheumatoid arthritis, allergies and even certain diseases of the skin, are influenced by stress and strain and aggravated by the alarm reaction of Selye.[5]

In certain persons, the gastrointestinal tract is extremely sensitive to stress and strain. During the alarm reaction, the predominantly adrenergic stimulation with contraction of the gastrointestinal vessels and muscles is well known. It may cause acute ulcer and often causes diarrhea, constipation, nausea and vomiting. The susceptibility and the extent of reaction to these stimuli depend in great part on the type of nervous system the person inherited from his forebears.

Cortisone and ACTH are not the answer to the problem of therapy. Cortisone, which has been reported by some authors to relieve the symptoms of ulcer, also causes atrophy of the adrenal glands in experimental animals. ACTH, according to the clinical reports I have read, increases the symptoms of ulcer in the majority of cases.

Beaumont was probably the first man actually to observe (in the case of Alexis St. Martin) that gastric function, at least, is obviously altered by psychic influences.

Practically all the physiochemical studies have been made on the stomach instead of on the duodenum and its secretions, and yet it is with duodenal ulcer that surgeons are most often confronted and concerned.

MacLellan[6] wrote, possibly facetiously, of duodenal ulcers as one of the degenerative changes of civilization. He remarked that the teeth, jaws and stomach of animals and primitive men were accustomed to tearing raw foods to shreds and receiving them for digestion on a stronger mucosa than modern men possess, and with a digestive juice made stronger by necessary combat for survival. Today, though human beings still are exposed to emotional stress and strain, long years of subsistence on processed foods have weakened the digestive tract and increased its susceptibility to disease. There may be some fancy in this line of thought, but many ponderous scientific thoughts of fifty years ago are laughable today, so may not the fanciful thought of today be considered scientific fifty years hence? Unfortunately, MacLellan did not support his line of thought, and he reported a series of cases in which he further weakened the stomach by a modification of the Wilson-Hey operation, reduced the blood supply with multiple ligations of vessels on the lesser and greater curvatures and added posterior gastroenterostomy to this attack!

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[2] Sandweiss, D. J., and Sugarman, M. H.: Symposium on Peptic Ulcer, Rev. Gastroenterol. Assoc. 1951, p. 406. 19:271-285 (April) 1952.

[3] Crile, G. W.: The Kinetic System and its Control. South. Surgeon. 1:157, 1932.

[4] Crile, G. W.: Newer Methods of Treating Peptic Ulcer, Constipation and Indigestion, N. Y. State J. Med. 35:442, 1935.

[5] Selye, H.: Stress, Acta, Inc., Montreal, Canada, 1950.

[6] MacLellan, E.: Conservative Surgery of Duodenal Ulcer, Lancet 2:257, 1951.

Duodenal ulcer is probably the only condition, aside from trophic ulcer of the leg, in which surgeons remove other tissue or denervate it and do not, in many cases, remove the offending lesion—the ulcer itself!

Surgeons speak and write at length about the baneful activity of parasympathetic (vagal) stimulation and seldom mention the possible role of dysfunction in the balancing sympathetic nervous system.

Study of the entire autonomic nervous system may help clarify the physiopathologic cause of ulcer of the duodenum, and the answer may well come out of physiologic and biochemical studies of the adrenal gland.

The aim of both medical men and surgeons is the same—to return the patient to a useful and productive life.

For duodenal ulcer, as for many other disease processes on which there is a wide difference of opinion and for which a variety of methods of cure has been offered, it must be realized that no treatment so far has been found completely successful.

A surgical procedure or medical method which works well in the hands of one physician should work equally well in the hands of others of equal technical skill. However, in the treatment of duodenal ulcer this is definitely not so. Therefore, physicians must look for and evaluate the other factors already mentioned.

After any surgical procedure so far devised for the cure or relief of ulcer of the duodenum, the patient is left with impairment of the upper part of the digestive tract.

It has been said that any competent surgeon can do a partial gastric resection, vagotomy or gastroenterostomy—but should he?

The attending physician often is disgruntled to have returned to his care the patient in whom attempted "surgical cure" of a duodenal ulcer has had a poor result. This viewpoint can be understood, especially if the "indications" for surgical intervention were not carefully evaluated.

Surgeons need not apologize, however, for all recurrences. Duodenal ulcer is characteristically a recurrent disease, with recurrence after medical treatment in as many as 80 per cent of cases of uncomplicated ulcer.[7]

When surgical intervention is necessary for "virulent" ulcer with or without perforation, penetration, hemorrhage or obstruction, recurrence follows partial gastrectomy in 10 to 15 per cent of cases if the ulcer itself is also resected. Dragstedt,[8] Crile and others have claimed equally good results following vagotomy (usually with gastroenterostomy).

The point is that, regardless of the type of operation, the re-education of the patient on the problems of his pattern of life, his success in adaptation and the extent of his ability to assume responsibility for the further care of his digestive tract play a great part in the final classification of the result as good, fair or poor.

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[7] Sandweiss, O. J., and others: Peptic Ulcer, Trans. Am. Gastroenterol. A. 1951, p. 446.

[8] Dragstedt, L. R.: Vagotomy for Gastro-duodenal Ulcer, Ann. Surg. 122:973, 1945.

The inimitable Hertzler often said "you can take the goiter out of the darned fool, but you'll still have the darned fool left!" This is equally apt with regard to duodenal ulcer.

In the evaluation of a surgical procedure there are so many variable factors which influence the published results that it is difficult to interpret them correctly. Inevitably one's own conceptions influence the appraisal.

The surgeon who is aggressive, alert and ambitious enough to devise a new procedure cannot help being impressed with his brain child and, like a doting parent, being blind to some things, and not dishonestly; but in his enthusiasm how can he always grade results between unsatisfactory and satisfactory?

Besides the previously mentioned highly variable traits in the patient himself, the completeness of the operation undertaken certainly influences results, and certain points should be questioned.

*In vagotomy, for instance,* were all the fibers severed, and did the acid response to insulin disappear after operation? Was gastroenterostomy done also and, if so, of what type and position, and was its styling adequate?

In partial gastrectomy, how partial was *it? Was it only "a ceremonial circumcision* of the stomach," as Ogilvie[9] was wont to label the procedure, or was three-fourths of the stomach (at least 175 Gm. or more, as advocated by Wangensteen[10]) removed? It is easy to be too optimistic about how much of the stomach has been removed unless the surgeon carries resection to the highest branch of the left gastric artery, places the clamp well above it on the lesser curvature and then, after removing the entire greater omentum, feels along the greater curvature to the cardia to estimate how much higher he must go to resect the desired three-fourths of the gastric tissue.

An adequate gastric resection, as described, eliminates the humeral secretory response through removal of the antral mucosa. It also decreases psychic stimulation through the vagus nerves somewhat, because of their interruption high on the lesser curvature and relatively high on the greater curvature. However, Shapiro and Berg[11] observed the secretion of returned gastric acid after partial resection and bilateral vagotomy below the diaphragm, and surmised that this was due to a possible compensating mechanism through the plexuses of Meisner and Auerbach in the wall of the stomach.

In partial gastric resection, that portion of the vagus nerves supplying the liver, pancreas, duodenum and spleen is not re*moved, and in long term study of results* retention of these fibers may be found beneficial. I am of the opinion that high interruption of the vagus nerves may in time show harmful physiologic results in other organs which have been deprived of their vagal supply.

*The final evaluation of vagotomy with* or without gastroenterostomy must wait another five years. Vansant[12] reported that in dogs gastric acidity had returned to normal four years after vagotomy.

Gastroenterostomy, which someone has called "a disease rather than an operation," *is probably acceptable only in cases of obstruction* with a low level of gastric acidity when the surgical risk is poor, resection is impossible and the aim must be palliation only.

Partial gastrectomy in the hands of a competent surgeon and an equally com*petent anesthetist can be done with a mortality* rate around 3.5 per cent. It should not be done by the casual operator in a substandard operating room or hospital. The complications of good gastric resection are much fewer than those accompanying vagotomy, and the overall percentage of good results seems much better, in my evaluation at least.

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[9] Ogilvie, H.: Gastrectomy: A Human Experiment, Lancet 2:377, 1947.

[10] Wangensteen, O. H.: Causes of Failure after Gastric Resection for Ulcer, etc., Wisconsin M. J. 44:878, 1945.

[11] Shapiro, B. F., and Berg., B. N.: Return of Gastric Acidity after Subtotal Gastric Resection and Bilateral Vagotomy, Arch. Surg. 28:160, 1934.

[12] Vansant, F. R.: Late Effects of Section of the Vagi Nerves (dogs) on Gastric Acidity, A J. Physiol. 97:375, 1931.

Strauss and associates in the Michael Reese Stomach Surgery Group[13] have reduced the mortality rate following partial resection from 3.5 per cent between 1917 and 1938 to 1.4 per cent between 1938 and 1950 by using spinal anesthetics, antibiotics and adequate replacement of blood. Results comparable to these should be the goal of all surgeons engaged in the relief of patients afflicted with "chronic" duodenal ulceration and its complications.

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[13] Strauss, A. A., and others: Results of Subtotal Gastrectomy for Gastric and Duodenal Ulcer since 1947, J.A.M.A. —:1095, 1952.

# A Milestone of Surgical Progress

## Argentine Section Meets Challenging Need

REVISTA

DEL

CAPITULO ARGENTINO

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COLEGIO INTERNACIONAL
DE CIRUJANOS

Tomo I — Octubre a Diciembre 1952 — N° 4
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Facsimile of cover of official organ of the Argentine Section, International College of Surgeons.

Readers of the Journal and Bulletin will doubtless remember that in the September 1953 issue of the latter there appeared a well-deserved tribute to the Argentine Section of the International College of Surgeons, which, in addition to countless other vitally valuable activities, had then just announced publication of its own official organ, *Revista del Capitulo Argentina, Colegio Internacional de Cirujanos.*

This remarkable journal appears quarterly and has set itself no less a goal than the abstracting and presentation of *all* the Argentine surgical literature every year. Under the able leadership of its Director, **Prof. Dr. Jorge A. Taiana, F.I.C.S.**, and its devoted Editor and Administrator, **Sr. Carlos A. Irianni**, this goal has been most creditably achieved. The Journal of the International College of Surgeons, in giving credit where credit is due, greatly prefers demonstration to description and takes great pleasure in letting *Revista del Capitulo Argentina* speak for itself. On Page 325 *(opposite)* and the following pages we present *in toto*, after their careful translation into English, abstracts of the entire Argentine surgical literature for the first half of the year 1954. We believe that all our readers, in whatever part of the world they live and serve, will share the pleasure of the College in such an achievement and in our congratulations to those who have made it possible.

M. T.

# Review of Argentine Surgical Literature
## First Half of 1954

### ANESTHESIOLOGY

**Cabo, H. A.: Use of Procaine Hydrochlorate for General Anesthesia in Thoracic Surgery,** Semana med. 103:857, 1953.

After general remarks and a brief survey of the literature, the author reports his own wide experience in the use of the drug in question. Trials began late in 1950 in order to assess advantages and disadvantages. His experience totals 181 operations, of which 44 were cardiovascular and 137 pulmonary.

He has used the drug alone and in combination with other anesthetics and analgesics. In combined anesthesia, the quantity of each of the complementary agents necessary was less than without procaine. Except for slight and short-lived cyanoses in a few cases and some moderate hypertension that disappeared as the infusion slowed, he encountered no accident or grave complication attributable to the drug.

When given intravenously, as the author gives it, procaine hydrochlorate proved so useful in maintaining anesthesia that he uses it almost invariably. It has its possible dangers, however, and should be used only by an anesthesiologist who is conversant with its pharmacologic nature. The patient should be watched carefully while under its effect.

**Donato, V. M. and Ursi, R.: Spinal Anesthesia with "Heavy" Nupercaine in Forceps Application,** Prensa med. argent. 41:121, 1954.

On the basis of a study of 42 applications of forceps the authors state:

1. That "saddle block" technic with heavy Nupercaine is simple and affords thoroughly good anesthesia in every case.
2. The cervix and the soft tissues of the vulva and the perineum are well relaxed.
3. Uterine contractibility is not modified.
4. There are no signs of fetal asphyxia.
5. The third stage of labor is spontaneous and the hemorrhage normal.
6. Arterial hypotension, if any, is slight and easy to handle.
7. No upsets occur during the puerperium as a result.
8. In one-fifth of the cases a postanesthetic headache appears. It is moderate and is easily overcome by adequate treatment.

To judge by results, saddle block anesthesia with heavy Nupercaine is an excellent method for obstetric anesthesia.

**Pasman, R. E.: Postoperative Complications in Abdominal Surgery,** Prensa med. argent. 41:567, 1954. (Read at the Fourth Argentine Congress of Anesthesiology, Buenos Aires, October 1953.)

The author discusses the importance of reliable anesthesia in avoiding postoperative complications; he has maintained the view for many years that specialization in anesthesiology is necessary, so that the surgeon may rely on the anesthesiologist and give all his attention to the operation proper, free from any distracting influence.

Some other aspects of immediate postoperative complications are discussed, but those which do not appear for several days after anesthesia and operation have been deliberately left out.

### SURGERY OF SPLEEN & HEMATOPOIETIC ORGANS

**Puyo Villafane, E.: Splenectomy for Hypersplenism,** Semana med. 104:209, 1954.

Several of the pictures considered by classic authors to indicate damage to the splenic gland correspond to primitive overactivity of the spleen. This had already been pointed out by early writers, and such manifestations have come to be grouped nowadays under the functional syndrome known as hypersplenism. The case history of 1 patient observed by the author is given, and the hematologic syndromes described by Wiseman and Doan as forms of hypersplenism are discussed. Of fundamental interest from a surgical point of view are the hypersplenic syndromes with anemia (icterus or hemolytic anemia, both congenital) or with thrombopenia (idiopathic purpura), since they are the only ones that respond to splenectomy satisfactorily and with any constancy.

The subject is discussed with reference to the opinions of divers workers; various aspects of the surgical treatment of the s [illegible] ee and the surgical r [illegible] 'hic [illegible] ries

3 and 6 per cent, are also discussed. The consensus is that splenectomy is the only curative therapy for congenital hemolytic icterus.

**Cipolla, E. B.; Caluroi, A. N., and Adorni, E. O.: Giant Follicular Lymphoblastoma,** Prensa med. argent. 41:277, 1954.

The history of a case of the adenosplenohepatointestinal form of giant follicular lymphoblastoma which developed as lymphosarcoma, observed by the authors, is reported and the subject brought up to date.

The history and pathologic picture, usually with involvement of the lymph glands, spleen, bone marrow and other less frequent sites (liver, skin, tear glands, tonsils, bones and intestine), the etiologic and pathogenic factors, the clinical picture, the clinical course, the prognosis and the treatment are reviewed. The condition is exquisitely sensitive to roentgen therapy, which is the treatment of choice; operation has been attempted in the excision of lymph glands. In the presence of splenomegalic forms of the condition splenectomy is advised, as it is followed by clinical improvement and the correction of thrombocytopenia.

Finally, the authors refer to Brill-Symmers' disease and pathologic conditions of the lymph glands, stating their attitude as to the position occupied by this condition in glandular disease. They favor the concept of Custer and Bernhard that giant follicular lymphoblastoma is the condition that most rarely retains its identity in the course of its development, for in time it changes to lymphosarcoma, reticulosarcoma, Hodgkin's disease or lymphatic leukosis.

**Maggi, A. C., and Margulis, E.: Brill-Symmers' Disease,** Prensa med. argent. 41:845, 1954.

A new Argentine case is added to the Argentine literature, of the condition variously called giant follicular lymphoblastome, Brill's disease, Baher's disease, Rosenthal's disease or Brill-Symmers' disease. Its history is reviewed and its clinical, pathologic, developmental and therapeutic elements outlined, which, in the absence of a known cause or causes, define the condition. In the authors' case patient 61 years old complained of pain splenomegaly, then superficial adenopathy around to the neck and spreading to both axillae, the left arm and the groins. Generalized pruritus was also present. Blood films were obtained; glandular and sternal punctures were performed. Negative results from Wasserman and Kahn tests and from a tuberculin test made it possible to eliminate leukemic lymphadenoma, malignant lymphogranuloma and chronic inflamatory conditions of known causation. Microscopic study of the cervical adenopathic condition led to its identification as that described by Brill, Baher and Rosenthal as generalized giant hyperplasia of lymph gland follicles and spleen, or giant follicular lymphoblastoma.

The authors wonder whether the condition is a benign variant of lymphosarcoma or a tumor in its own right, ranking somewhere between benign and malignant tumors, or a borderline type, a premonitory phase of some very serious condition. All these are mere hypotheses awaiting confirmation, since the subject is under constant revision.

## SURGERY OF HEAD AND NECK

**Mosca, L. G.: Radium Therapy of Malignant Tumors of Cranium,** Prensa med. argent. 41:812, 1954.

On comparison of papers published before 1939 with more recent work it is evident that there has been a radical change in the indications for radium therapy as well as the dosage. Most writers, though not all, used to maintain that irradiation with a closed cranium was seriously dangerous.

The indications for glioblastoma and other growths, including vascular tumors, are discussed, as are radiosensitivity, technic and preoperative irradiation.

Surgery is not radium therapy's rival but its complement. The current tendency favors operation when the patient's condition allows, when function is not seriously jeopardized and when the tumor lies in an accessible place. Operation has the last word as to the extent and microscopic nature of the tumor.

**Nocito, F. J. and Abravanel, R.: Hemangioma of the Cranial Vault: Resection and Acrylic Prosthesis,** Soc. de Cir. de Buenos Aires Bol. y Trab. 37:647, 1953.

Hemangioma of bone is a very rare type of tumor, and the cranial location adds to its medical and therapeutic interest. Of the rarity of this tumor it has been said that no single author has encountered more than 1 or 2 cases. The authors, having had occasion to treat 2 patients with cranial hemangioma, consider publication is justified.

Both cases are reported, and the symptoms, clinical course, diagnosis and differential diagnosis are discussed. Treatment may be surgical; or roentgen rays, which halt the development of the tumor, which may be cured after an intense hyperostotic reaction. In some sites, such as the spine, roentgen therapy is in order. For hemangiomas of the cranial vault the authors prefer operation, especially when the scar is hidden by the patient's hair. They find craniectomy advisable, with an acrylic prosthesis well tolerated by the body. Cure for the disease is thus obtained definitively in a short time and without the hyperostotic reaction.

**Marino, H. and Yoel, J.: Electrical Excitation in Surgery of Face and Neck,** Soc. de Cir. de Buenos Aires. Bol. y Trab. 37:583, 1953.

Faradic excitation of the motor nerves of the face and neck is considered an indispensable adjunct to the surgical treatment of those regions. It serves to determine quickly and precisely which is the proper trajectory, since this may have been altered by pathologic change. Their preservation is thus made possible in difficult circumstances such as those brought about by parotid tumors and stripping of lymph glands.

The inherent technical problems are discussed and the most adequate types of current, intensity and generating apparatus described. The peculiarities of anesthesia are pointed out. The authors conclude that these considerations are not reason enough for depriving the patient of the certainty or the surgeon of the comfort and peace of mind afforded by the method.

## EXPERIMENTAL SURGERY

**Ghersi, J. A.; Costales, A., and Mayo, F.: Possibilities of Pentothal Anesthesia in the Artery Canalized During Cerebral Angeiography,** Prensa med. argent. 41:800, 1954.

1. The possibility of using the artery canalized for sodium pentothal anesthesia during cerebral angeiographic procedures is suggested.
2. In the investigation, it was kept in mind that at the usual sites of injection, in the fold of the elbow, this drug is known to causes venous thrombosis.
3. The literature records cases of thrombosis due to accidental intra-arterial injection of the anesthetic.
4. Animal experiments were made in which electroencephalographic study was followed by pathologic examination of the carotid arteries and the brain.
5. The animal encephalograms showed gross deterioration in bioelectric activity, ranging from the appearance of slow waves to the disappearance of all activity on sudden death.
6. Pathologic examination showed carotid thrombosis in both early and late specimens, as well as microscopic hemorrhage from rupture of capillaries in nervous tissue.
7. The authors conclude that the intra-arterial use of this drug for anesthetic purposes must be ruled out at present, but they are continuing their experiments with more dilute solutions and other drugs and noting the neurophysiologic effects.

**Urrutia, J. M., and Yornet, H. M.: Experimental Effect of Hyperestrinism on Animal Liver Cells,** Soc. de Cir. de Buenos Aires Bol. y Trab. 37:661, 1953.

The authors have observed that estrogens have an important effect on the liver cells of female guinea pigs when injected until the proliferative stage of genital epithelium is reached. Hyperestrinism undoubtedly forced the liver to play its part in estrogen metabolism until the changes observed were produced.

It is the authors' intention to attempt to fill in a blank in the current knowledge of estrogen metabolism and to pave the way for further studies on the possible action of these bodies on the composition and secretion of bile, of which they already have an inkling, though they are not yet ready to draw conclusions.

**Juri, A. G.: Microscopic Pathology of Liver Necrosis Following Experimental Ligature of Hepatic Artery in Dogs,** Soc. de Cir. de Cordoba Bol. y Trab. 4-5-6-7:134 (June-July) 1953.

Earlier authors' experiments on ligature of the hepatic artery in the dog were repeated. In addition to ligature of hepatic, splenic, right gastric and gastroduodenal arteries, a Billroth II gastrectomy [illegible] formed.

All the dogs died [illegible] ninety-six hours [illegible]

Grossly [illegible]

microscope showed almost complete disorganization of the trabeculae, with central lobular and diffuse changes. Necrotic foci were present, containing millions of bacilli that stained with hematoxylin and having spores (Clostridium tentani?).

The remaining changes were attributed to toxins, enzymes (hyaluronidase, colgenase), etc.

## GASTROINTESTINAL SURGERY

**Garimaldi, U.: Diet Therapy for Stomach Operations,** Orientacion Medica 66:328 (Dec. 4) 1953.

A study is made of the physiologic mechanism of digestion and its alterations after gastric surgery; dietetic management most suited to each case is outlined, in order to correct these pernicious changes.

**Rozenblum, Chaja Sura: Abdominal Forms of Vomiting with Acetonemia,** Orientacion Medica 66:344 (Dec. 4) 1953.

A doctor's thesis on this disease peculiar to childhood, characterized by fits of vomiting with acetonemia and acetonuria that are repeated during one or more days, stop suddenly, reappear during several years with the same manifestations and disappear finally when the child is between 10 and 14 years of age.

Symptoms, clinical forms, causation, pathogenesis differential diagnosis, prognosis and medical treatment are reviewed. The author's conclusions from analysis of this disease are as follows:

1. Abdominal forms of acetonemia imitate acute appendicitis.
2. Both may be present.
3. In case of doubt, operate (avoiding use of ether and chloroform).

**Meeroff, M.: Medical Treatment of Massive Digestive Hemorrhage,** Orientacion Med. 69:401 (Dec. 25) 1953.

The author sets forth clearly and in order the stages in diagnosis of massive digestive hemorrhage and the treatment advisable for the various clinical situations arising. The author's personal opinion on problems in the treatment of these patients is presented.

The paper falls under the following heads, each of which is minutely analyzed: scope of subject; bleeding; stages in diagnosis, and treatment. As for the last-named, operation is in order for ulcers with massive bleeding that resist medical treatment or require operation from the start. Preoperative care and surgical technic suitable to such cases is briefly outlined.

The paper closes with an analysis of results obtained by the author by the management he describes.

**Ferreira, J. A.: Juxtacardial Gastric Diverticulum,** Soc. de Cir. de Buenos Aires Bol. y Trab. 37:600, 1953.

The author approaches the condition chiefly from the point of view of surgical therapy, and reports a case. The following conclusions are reached:

1. Juxtacardial diverticulum is the most common form of true gastric diverticulum (76 per cent).
2. Its situation makes it prone to diverticulitis and its sequelae.
3. The symptoms are not characteristic, and its presence can only be surmised.
4. The diagnosis is essentially roentgenologic.
5. Gastroscopic study should be undertaken only after roentgen study has determined the location, never as a routine; it can prove invaluable for the diagnosis of diverticulosis.
6. Latent diverticula, discovered incidentally in roentgen exploration, require no treatment but should be kept under observation.
7. Painful dyspeptic conditions referable to a diverticulum may benefit by medical management but can never be pronounced cured.
8. Intractable symptoms demand surgical intervention. One may follow the abdominal, thoracic or combined route, approaching from the greater or lesser curvature according to the circumstances, the diverticulum being excised or invaginated.
9. The possibility or certainty of associated lesions must be borne in mind in choosing a route. The patient's constitutional type is also important. If a coexising lesion demands operation, the diverticulum can and should be excised.

**Meeroff, M.: Early Diagnosis of Gastric Cancer (First Report),** Prensa med. argent. 41:62, 1954.

The author describes likely bearers of gastric cancer, since early diagnosis poses two main questions to work on while biologic investigation prepares the way to solution of the cancer problem fundamentally and in general. The two questions are: who shall be examined, and how?

The three kinds of people to be suspected if gastric cancer is to be diagnosed early are, briefly, those with symptoms and signs referable to gastric cancer: those who have a disease considered precancerous, and those with neoplastic heredity or family history, especially digestive and particularly gastric.

In the first group, gastric cancer may be suspected in any person, especially if male, who begins to complain of gastric distress after 40.

As to the second, chronic gastritis, pernicious anemia and benign tumors of the stomach should be examined; gastric ulcer is still open to discussion.

Concerning the third group, although many authors reject a hereditary cause of gastric cancer, the existence of families in which there is a high incidence of the disease has been proved. Any patient who belongs to one of those families, therefore, should be checked routinely, especially if he has anachlorhydria or microcytic anemia.

The author will deal with the manner in which these "suspects" should be studied in another paper.

**Meeroff, M.: Early Diagnosis of Gastric Cancer (Second Report),** Prensa med. argent. 41:358, 1954.

In connection with early diagnosis of gastric cancer, the author has already referred to the persons who should be examined to that end. In this work he refers to the manner in which this examination should be carried out. He, therefore, reviews roentgen study (early roentgen signs, signs of infiltration, ulceration and of vegetating forms; location of neoplasm); gastroscopic study; gastric cytologic study; biopsy of the stomach; other diagnostic media; gastric secretion; occult blood in feces; the Woldmann test; the blood cytologic picture; protidemia; biological tests; exploratory laparotomy and, finally, test treatment.

These procedures are listed in the order of their usefulness, and the author comments on them in detail. This paper is of great interest as a guide in the study of those patients for whom an early diagnosis of cancer may avert a tragedy.

**Del Valle, D.: Total Gastrectomy for Cancer,** Soc. de Cir. de Buenos Aires Bol. y Trab. 37:639, 1953.

Roentgenograms are exhibited of a 68-year-old patient with a gastric obstructive syndrome due to plastic linitis, infiltrating nearly all of the pyloric region and fundus and apparently leaving only a small air chamber unaffected.

The operation was performed purely by the abdominal route, but the xyphoid process was completely excised. A short commentary follows, and the author points out that roentgen study after operation shows the formation of a small stomach from two loops of small intestine widely joined in a parallel manner. The technical innovation and good function obtained motivated the author's communication.

**Canonico, A. N.: Gastric Cancer Recidivating After Operation: Wide Excision of Remaining Tumor and Several Neighboring Organs,** Soc. de Cir. de Buenos Aires Bol. y Trab. 37:682, 1953.

A woman underwent a wide subtotal gastrectomy for malignant disease of the prepyloric zone of the stomach, with resection of a small wedge of liver for neoplastic invasion. Pathologic study showed mucus-secreting adenocarcinoma with metastases in glands of the small and large curvatures near the lesion. The patient returned eight months later with a palpable lump the size of a tangerine at the site of the previous operation, with evident deterioration of her general health and without physical or roentgen signs in the lung or any other part.

A second operation was performed, including excision of a tumor mass from the soft tissues of the abdominal wall, and another tumor block was disclosed. Its close connection with both liver and colon made it necessary to excise parts of the right lobe of the liver, the gall-bladder, part of the head of the pancreas and part of the transverse portion of the colon. The ends of the colon were joined in gun-barrel fashion because it was not considered suitable to make an end-to-end anastomosis. The postoperative course was favorable, and the colostomy was later closed extraperitoneally.

At the end operation the gastroenteroanastomosis was in very good condition, indicating that the danger of cancer of the gastric antrum does not always lie in the neighborhood of the stomach itself, and great attention must be paid to the possibility of lymphatic infiltration of the duodenopancreatic sector.

**Canonico, A. N.: Gastric Cancer: Subtotal Gastrectomy: Exploring Relaparotomy,** Soc. de Cir. de Buenos Aires Bol. y Trab. 37:684, 1953.

A patient is described on whom extensive gastrectomy by the Reichel-Polya technic was performed for epithelioma of the gastric antrum, with metastasis in glands near the large curvature. Eight months later, with the patient in good general health and free from symptoms, a second exploratory operation was proposed, the "detection plan" being followed in search of possible malignant residua before their advanced state caused clinical signs of their presence.

A second laparotomy was performed; the gastroenteroanastomosis was in good condition, and there was only 1 enlarged gland in the omentum majus, shown by pathologic study to be inflammatory. After more than two years the patient was enjoying good health both clinically and roentgenographically. This goes to prove that one must be careful in the choice of an operative procedure for this condition, acting according to the type and site of the tumor in each case, guided by data collected in the course of operation. The author does not consider routine total gastrectomy the solution for gastric cancer; rather, it is his opinion that an ample subtotal excision is useful in many cases if associated with "exploring relaparotomy," which he evidently considers important.

**Schwartz, M. M.: Situs Inversus Totalis,** Sol. soc. de Cir. de Rosario 21:111, 1953.

The case of a patient with situs inversus totalis is presented, in whose case it was necessary to perform an operation for chronic gastric ulcer. A duodenal diverticulum was observed at operation.

Ample pyloric gastrectomy was performed, plus excision of the diverticulum. The postoperative course was ideal, and the patient enjoyed good health at the time the report was written. Follow-ups showed good function of the new os.

**Fongi, E. G.; Bustos Fernadez, I.; Angulo, H. C., and Gauna, E. F.: Pernicious Anemia Appearing After Subtotal Gastrectomy,** Prensa med. argent. 41:283, 1954.

Pernicious anemia appeared five years after subtotal gastrectomy was performed for duodenal ulcer. The possibility that the anemia may have been caused by excision of gastric tissue is discussed.

**Puyo Villafane, E.: Total Gastrectomy,** Prensa med. argent. 41:49, 1954.

In connection with certain technical problems arising in total excision of the stomach, progress in performance of the operation, routes of access, types of anastomosis and immediate results make critical review of the procedure possible. Current statistics refer to total gastrectomy performed *of necessity,* imposed by the extent of the lesions, but the author considers total gastrectomy *on principle* in view of the discouraging results of subtotal resection for gastric carcinoma.

Three groups of gastric carcinomas described by Covert are reviewed from an essentially surgical point of view: those of the cardia, those of the proximal third of the stomach and those of the distal third, as well as extensive cancers.

The author states that insufficient data are available for comparative study of the end results. However, as long as gastric cancer continues to be within the field of surgical therapy, operations of increasing extent are justified. According to Rudler, it is a tenet of surgical philosophy that no patient who has no other hope of survival should be denied radical operation.

**Gorni, D.: Idiopathic Megaduodenum and Gastric Ulcer; Gastrectomy; Healing,** Bol. Soc. de Cir. de Rosario 20:105, 1953.

In a case of megaduodenum with gastric ulcer the patient was treated by gastrectomy, because that is the author's treatment for gastric ulcer. As for the megaduodenum, in his opinion, avoiding the passage of food after gastrectomy has reduced the amount of work performed and caused improvement without any need for an operation on the duodenum itself.

**Justiniano, E., and Carpanelli, J. B.: Therapeutic Management of Perforated Gastro-Duodenal Ulcer,** Orientacion Medica 67:353 (Dec. 11) 1953.

Surgeons have not yet been able to agree about treatment of perforate ulcer. Some are conservation, others radical; among the latter are the authors of this paper, who, out of their vast experience, indicate the therapeutic criteria they apply to treatment of this condition and the circumstances determining the choice of a surgical technic.

**Jaroslavsky, L.: Our Conduct When Faced With Duodenal Ulcer,** Orientacion Medica 70:437 (Jan. 1) 1954.

After reviewing procedures used by earlier authors in the treatment of patients with duodenal ulcer, the author describes his own. As for the ulcer with bleeding, he says, if it is on the small curvature the callous zone surrounding it must be excised and the breach sutured in two layers, in the direction that obviates the danger of stenosis. When the ulcer is situated on the duodenum, subtotal gastrectomy is in order; bleeding lesions on the posterior surface of the duodenum are exceptional, free from inflammation and fit for suture *in situ*.

**Turco, N. B., and Vazquez, M.: Segment Excision in Gastric and Duodenal Ulcer,** Arch. Argent. de Enferm. d. Ap. Digest. 28:27, 1953.

Immediate and end results are presented of 6 segmental excisions as advised by Wangensteen. Operation was indicated in all cases; there were 3 ulcers on the anterior surface of the duodenum, 2 posterior (1 with and 1 without bleeding) and 1 stomach ulcer. All 3 on the anterior surface and the gastric ulcers were excised. The 2 on the posterior surface were left in. All the patients were men aged 28 to 54.

General combined intravenous and inhalation anesthesia was employed. A transverse celiotomic epigastric incision was made. The question of segmental excision was decided after laparotomy. Excessive adhesions, inflammatory infiltration, stenosis from sclerosis of the ulcer, negative results from biopsy, etc., led to rejection of the attempt. Except in the first case Finney's ample pyloroplasty was performed, efforts being made to insure that the transverse suture left a good pylorus, for which oblique sutures were used on occasion. Liberation of the origins of the coronary and gastroepiploic (left) arteries and all the short vessels was then performed. The gastric stump was irrigated by the posterior gastric blood vessels. The second stage is an end-to-end anastomosis: the gastric stump measured barely 2 inches (5 cm.) square. The small curvature was completely excised; nothing was left but what was needed to insure a good suture.

The immediate postoperative course was good. Improvement was rapid, and the patients were sent home ten or twelve days after admission. The first (no pyloroplasty) had slight signs of heart failure; the third and fourth (posterior ulcer) had slight perfectly tractable immediate dumping, failure to gain weight, no pain, hypochylia and hypochlorhydria.

Comments on the rationale of this operation are included.

**Meeroff, M.: Prolapse of Gastric Mucosa into Duodenum.** Prensa med. argent. 41:607, 1954.

History, literature, pathologic picture and etiologic factors of this condition are described. There is no clinical picture that makes it possible even to suspect prolapse. The physical signs and complementary examinations, roentgen study, differential roentgen diagnosis, course and treatment are extensively discussed.

The management preferred nowadays is as follows: 1. One should begin with medical treatment unless complications make operation necessary. Treatment is practically the same as for an ulcer. 2. Operation should be performed if a reasonable trial of the aforesaid means is unsuccessful or surgical complications crop up: (persistent pain; pyloric obstruction with vomiting and deterioration of general health; profuse bleeding, or secondary anemia).

Several operations have been suggested, from simple scarification of redundant mucosa to subtotal gastrectomy, with all the variations possible in between: excision of excess mucosa, antrotomy, divers pyloroplasties, gastroenteroanastomosis, a combination of excision of mucosa with antrotomy and pyloroplasty, etc. There is no experience with vagotomy, but Feldman has suggested it in view of the beneficial action of blockers of ganglion synapse.

**Schena, A. T.; Lemberg, A., and Apartin, A.: Extrinsic Compression of Duodenum,** Arch. Argent. de Enferm. d. Ap. Digest 28:28, 1953.

Five cases of compression of the duodenum by divers conditions connected with gall ducts and pancreatic lesions are reported. In all of them, surgical proof of the conditions present was obtained. In the first there were gallstones and cholecystitis, with periduodenitis and an inflammatory tumor. In second, roentgen deformat of duodenum was observed. In urth there were sequelae of chronic pancreatitis leading to duodenal stenosis. In the fifth there was a large stone in the gallbladder, with pericholecystitis which greatly compressed the organ. Patients 1, 3 and 5 had a clinical pyloric syndrome; Patient 2 had a syndrome of compression of the common bile duct.

Therapy whenever possible was duodenolysis and treatment of the causative condition (Cases 2 and 5) by means of cholecystostomy; in the remainder gastroenteroanastomosis was necessary. Exploration in Case 1 revealed the duodenum completely stenosed. In the authors' opinion, gastroenteroanastomosis should be performed only when duodenolysis does not guarantee free transit in the duodenum.

Statistics are few and more work and comment are needed; therefore the authors' data are offered to other investigators.

**Aguirre, C.: Value of Esophagojejunostomy According to Roux-Herzen's Principle in Surgery of the Lower Third of the Esophagus and in Total Gastrectomy,** Prensa med. argent. 41:337, 1954.

The authors who have made use of the jejunal Y loop according to Roux-Herzen's principle for reconstruction of the intestinal passage after operations on the esophagus and stomach are reviewed chronologically.

Reflux esophagitis and the way to make up for loss of the protecting cardioesophageal valvular mechanism are remarked upon.

Three cases are reviewed (1 of tumor of lower third of esophagus, 1 of gastric tumor and 1 of giant ulcer). The lesions were treated successfully by excision of the distal portion of the esophagus and total gastrectomy, with reestablishment of the intestinal passage by means of Roux's Y-shaped loop.

A patient with megaesophagus underwent resection of the cardia and reconstruction of the intestinal passage with a Roux-Herzen Y-shaped loop, the stomach being left out of the digestive circuit. The operation was successful.

**Sylvestre Begnis, C.: Cancer of Right Colon Appearing on the Abdominal Wall,** Bol. Soc. de Cir. de Rosario 20:61, 1953.

A female patient had a tumor that had run its course in the ascending portion of the colon for over two years and presented invasion of the abdominal wall in the right flank. A large vegetating tumor weighing 35 Kg. was operated on in three stages.

1. Excision of the vegetating tumor.
2. Exploratory laparotomy which, showed that there were no metastases. The right half of the colon was excluded and intestinal continuity reestablished.
3. Excision of the whole piece in a single block, including whole right flank abdominal wall, the right half of the colon, part of the liver, part of the second portion of the duodenum, which was invaded and perforated, and the gallbladder. The wall was reconstructed with a sheet of bovine fascia and a pediculate total skin flap.

Forty-seven days after this third operation the patient had a severe obstructive syndrome demanding a fourth, when a solid adhesion joining small loops to the graft and the fluid of peritoneal reaction were observed. Dynamic ileus was diagnosed. It has been suggested that this complication may be avoided by first closing the breach with a sheet of peritoneum obtained from the opposite wall and placing the bovine fascia and skin over it, or by using fascia lata from the patient.

Eight months after the operation the patient enjoyed good health, weighed 50 Kg. and had a good abdominal wall.

**Trossero, A.: Nonspecific Inflammatory Tumor of Cecum: Infiltrating Segment Colitis,** Bol. Soc. de Cir. de Rosario 20:140, 1953.

The case presented was peculiar. A cecal tumor was diagnosed and removed on suspicion of malignancy, and microscopic study revealed that it was a localized sclerous inflammatory tumor of the cecal wall. Chronic inflammatory hyperplasia, when more or less circumscribed in a zone of the colon may cause palpable lumps that are hard to identify even with the aid of the several resources of physical examination and roentgen rays.

The history of the case is given and remarked upon, and the operation is described. Inflammatory tumors of small and large intestine, acute, subacute and chronic, are discussed and the literature reviewed; etiologic factors, pathogenesis, pathologic picture, physical signs, differential diagnosis, roentgen picture and surgical treatment are analyzed.

Treatment consists of short circuit or excision and is applied by preference when complications—stenosis, obstruction, fistulas, abscesses and perforations—appear. Operations chosen by divers authors are reviewed.

Trossero performed right hemicolectomy for two reasons: first, because he suspected a malignant lesion (lymphosarcoma), and second, because of the possibility that even were it not so the changes might reach and obstruct the ileocecal valve. Perhaps if he had performed immediate freezing biopsy he might not have been so generous in his excision, which would have been in order for hyperplastic tuberculosis but need not have been so extensive.

**Cernich, I. R.; Eguia, O. E., and Rosenberg, I.: Hodgkin's Sarcoma of Small Intestine,** Semana med. 104:157, 1954.

The case is reported, not because of the disease, which is common enough and has *been well studied, but for the variety* (sarcoma), which is its severest form, and the site, which was unusual—the small intestine.

The patient's history is given in detail. The operation and the gross and microscopic pathologic data on the specimen excised are described.

Physical examination of the patient on admission revealed all the symptoms of incomplete obstruction of the terminal portion of the small intestine. Laboratory tests (hemogram, sedimentation rate), in the absence of eosinophilia, splenic involvement or fever, pointed to benign tumor of the small intestine. That was the surgeon's impression, for at operation no infiltration of neighboring walls or mesentery was observed; the regional glands seemed normal. The pathologist's diagnosis, therefore, came as a surprise.

This was a pure intestinal form of Hodgkin's sarcoma that underwent its mutations (paragranuloma, granuloma, sarcoma) *in situ, appearing in an unusual manner without* apparent alteration of the reticuloendothelial system or any symptoms to awaken suspicion of Hodgkin's disease, much less of sarcoma.

**D'Alotto, V.; Gallastegui, C. A., and Code, H.: Malignant Tumours of Small Intestine,** Prensa med. argent. 41:57, 1954.

A clinical and roentgen study of 13 cases observed over twelve years is presented, representing 40 per cent of tumors of the digestive tract registered at the *Instituto Nacional* de Gastroenterolgia.

Location (duodenal, 5 per cent; jejunal 15 per cent; ileal 5 per cent); age (average 44); sex (female predominating, 5 per cent, which disagrees with the observations of other workers); pathologic character (most frequently adenocarcinoma and next lymphosarcoma, neither carcinoid nor melanoma having been observed by the authors); metastases (rare in adenocarcinoma except in scirrhous or ring cancer forms in which they are early, unusual in sarcoma and later; melanoma is considered a metastatic form of extraintestinal primitive tumor) are reviewed.

Symptoms (bleeding, obstruction, palpable lump); *general signs (neoplastic impregnation, anorexia, loss of weight and asthenia)*, and other symptoms, such as intractable jaundice in 1 case, caused by tumor of the second portion of the duodenum, invading Vater's ampulla, are analyzed.

Roentgen study gave the correct diagnosis in 100 per cent of cases. Laboratory tests showed occult blood in the feces in 3 cases and hypochromic anemia in 1.

The condition was suspected clinically before roentgen examination or operation confirmed it in 30 per cent of the cases.

**Radice, J C., and Kaplan, S.: Intestinal Occlusion by Dried Peaches (Carcinoid of Small Intestine and Sigmoid Adenocarcinoma),** Bol. y. Trab. de la Soc. Argent. de Cirujanos 23:713, 1953.

A case is reported of intestinal block brought about by swallowing dried peaches in large quantities without chewing, which were held up at the level of an intestinal carcinoid. *After excision of the tumor the* obstruction was repeated, and an emergency operation revealed an adenocarcinoma of the sigmoid.

The patient, a woman, had a history of repeated abdominal colic that originally *might have been attributed to chronic cholecystitis.*

**Dorado, H. J., and Daneri, I.: Hematogenous Acute Appendicitis,** Prensa med. argent. 41:130, 1954.

The authors report a case of their own observation, and go on to consider the pathogenesis of acute appendicitis, which turns on the route by which the ge[illegible] the appendix and attach themsel[illegible] cosa. They divide the hypot[illegible] plain the origin of infection groups: [illegible]

a. [illegible] blood for [illegible]

b. Intestinal: The germs come from the nearby ileum and cecum.

c. Pre-existent bacteria: The germs are already in the appendix and their virulence has increased.

Experience has confirmed the last-mentioned theory, but the hematogenous route has occasionally been observed, and the authors' comment on this subject. They emphasize its importance as a possibility that must not be lost sight of; for instance, when abdominal pain appears in a patient who has fever, appendicitis should be remembered as a possibility even when influenza, angina or tonsillitis has been diagnosed.

The picture is atypical, but there is always pain on the lower right side of the abdomen, and it should be ruled out by palpation each time the patient is examined.

**Luna, C. A. F., and Tinelli, J. C.: Retrocecal Acute Appendicitis,** Prensa med. argent. 41:286, 1954.

Attention is called to the seriousness of the condition; the frequency of the larval form is pointed out; outstanding signs and symptoms are remarked on; surgical technic is revised briefly, and a few cases in point are reported.

## GYNECOLOGICAL SURGERY

**Odisio, A. A., and Bazan, W. H.: Hemorrhagic Corpus Luteum: A Contribution to Casuistics,** Prensa med. argent. 41:286, 1954.

Four cases are reported. Operation was performed in the first 3 with a diagnosis of acute appendicitis; the diagnosis in the fourth case was presumable ovarian hemorrhage.

**Lienhard, C. P., and Halliburton, J. C.: Adenocarcinoma of Endometrium and Granulosa Cell Tumour: Personal Observation,** Prensa med. argent. 1:286, 1954.

A new case is reported of granulosa cell tumor of the ovary combined with adenocarcinoma of the endometrium in a patient who had two more growths, a uterine myoma and a dermoid cyst of the ovary on the contralateral side. Such an unusual combination of 4 growths in the same genital system suggests a hereditary predisposition.

The possible connection between endometrial carcinoma and granulosa cell tumor is discussed, considering that the former grew in a patient with the "blastomatous diathesis," encouraged by hyperestrogenism, as shown by pathologic and clinical criteria (myoma; polypoid hyperplasia of the endometrium; uterine bleeding). The possibility of other factors (chronic irritation, inflammation, virus infection, some factor similar to Bittner's milk factor) is not denied, and it is considered that further clinical and pathologic study will clarify the problem.

The literature is reviewed, and to Novak's 54 cases are added 21 plus the authors', bringing the total up to 76 for what Novak called combined tumors (feminizing tumor of the ovary and carcinoma of the endometrium). In 36 there was a granulosa cell tumor, (47.4 per cent), and in 40 a thecoma (52.6 per cent). The predominance of thecoma is curious, as this is much rarer than the granulosa cell tumor, a point in favor of those who argue that estrogen is secreted by the thecal elements even in granulosa cell tumors. The coexistence of uterine tumors with feminizing tumors of the uterus is frequent (45 per cent).

**Chiodi, J. H.; Sciortino, J. B., and Tinelli, J. C.: Acute Abdominal Disease Caused by *Hemoperitoneum* of *Non-Gravidic Ovarian* Origin,** Prensa med. argent. 41:527, 1954.

Fifteen out of 179 gynecologic hemoperitoneum observed over twelve years were due to ovarian causes. Hemoperitoneum was diagnosed in 4 cases. In 9 the condition was attributed to acute appendicitis, in 1 to torsion of an ovarian cyst pedicle and in 1 to acute cholecystitis. The cause was not determined in any case; (in those in which hemoperitoneum was diagnosed the acute disease was attributed to complicated ectopic pregnancy and in 1 to postoperative hemorrhage).

A case of phlegmonous appendicitis and bleeding ovary similar to that of Blanc, Blaine and Mauclaire is reported.

Culdocentesis was performed routinely in the presence of abdominal pictures resembling acute appendicitis.

Palpation by the Scandinavian maneuver, with the patient standing, is valuable in localizing the condition causing acute disease of the abdomen.

Jalaguier's incision provides an easy solution in doubtful cases. The purpose of the paper is to remind surgeons of the existence of the condition when faced with differential diagnosis of acute abdominal disease.

**Arganaraz, J. M., and Lederer Outes, J.: Demons-Meigs Syndrome,** Prensa med. argent. 41:540, 1954.

The authors report a case they consider important because of its rarity; in practice, few patients have ascitis and hydrothorax combined with a benign tumor of the ovary.

The literature is reviewed, anatomy, clinical course and prognosis of Meigs' syndrome are analyzed, and the case of the patient operated on by the author is reported.

This brief contribution to the literature on this syndrome ends with the remark that, whatever the patient's age, after a brief preoperative period, total excision of the tumor should be performed without delay. Once the condition has been diagnosed, which is not hard for a surgeon familiar with its features, operation should be performed immediately.

**Figueroa Casa, P.: Monophasic Cycles and Menstrual Rhythm,** Semana med. 104:151, 1954.

One hundred and thirty-three patients who complained of sterility were examined and endometrial biopsy performed routinely. In 56.39 per cent menstruation was regular; 43.6 per cent had changes in rhythm, quantity and duration. Of the first group, 2.66 per cent had proliferating endometrium; 90.66 per cent secreting and 6.66 per cent tuberculous endometritis. Of the second group, 77.58 per cent had proliferating or atrophic endometrium; 13.79 per cent secreting, and 8.62 per cent mixed.

Analyzing, the author draws the following conclusions:

1. Monophasic cycles are rare in women who menstruate regularly.
2. Such cycles are frequent in women who menstruate irregularly, but they may have biphasic cycles, which are more frequent than monophasic cycles in women who menstruate regularly.
3. Tuberculous endometritis is more frequent than anovulatory cycles in women who menstruate regularly.

**Nogues, A. E.; Guiza, H. L., and Otturi, J. E.: Treatment of Suppurating Ovaritis,** Semana med. 104:213, 1954.

Treatment of suppurating ovaritis is mainly surgical; antibiotics improve its course and surgical prognosis, but are unable to prevent the formation of the abscess once the stroma has become infiltrated, which is characteristic of the beginning of the disease. Physiotherapy, which can only be used in certain well-defined cases (settled chronic course, low sedimentation rate) improves conditions for operation but never effects a cure.

The excision of the lesion must be complete; operation may be conservative in young women (partial or unilateral oophorectomy, with or without salpingectomy) and radical (total adnexohysterectomy) in women near the menopause.

Drainage tends to be suppressed; the antibiotic drugs complement surgical treatment, their dosage depending on the nature and intensity of the infection; sulfa drugs are used locally during the operation. Thus complications are reduced and even deaths prevented.

**Albertelli, J. F., and Schiaveo, C. D.: End Results of Surgery for Sterility Due to Bilateral Tubal Obstruction: Its Value as a Basis for a New Plan of Treatment,** Semana med. 103:805, 1953.

Treatment of sterility due to bilateral tubal obstruction of many years' standing is disheartening, for when obstruction has reached an advanced stage the usual treatment is a failure. This may be due to unwise management at a time when there was yet hope. This is confirmed by the authors' experience. They have been successful with patients who had had no study or treatment.

When this is not the case, surgical correction of the obstruction is the only solution of the problem, but results obtained thus far are not encouraging. The authors, therefore, have added to the usual methods; their plan of management associates classic surgical treatment, medicine and physiotherapy, with ACTH or cortisone as an antiphlogistic. They give the rules that should be followed if failure is to be avoided.

End results are not yet obtainable so far as pregnancy is concerned, but permeability of the tubes is preserved in all the patients operated on. The authors state that, from a study of the literature, they seem to be the first to use ACTH for this purpose. That and the novelty of their surgical criterion justify the publication.

## SURGERY OF THE ENDOCRINES

**Tachella Costa, A.: Diagnosis and Treatment of Hyperthyroidism,** Semana med. 103:879, 1953.

A minute study of the subject is made. It is necessary to emphasize that if one considers the present state of surgical indications in cases of hyperthyroidism, the paradox becomes apparent that the best proof and measure of the value of medical treatment is the fact that under its influence it is now possible to operate almost without risk. Account must be taken also of more careful methods, better anesthesia and improved surgical technic.

Once clinical improvement has been obtained, it is not always easy to decide whether a medical or a surgical program should be chosen. The author gives a comparative table of advantages and disadvantages of the several treatments for hyperthyroidism, including iodine, surgical intervention and radioactive iodine, as a means of clearing up doubt.

## SURGERY OF LIVER, BILE DUCTS AND PANCREAS

**Delrio, J. M. A., and Guastavino, G. N.: Hepatoma with Recidivation and Amyloidosis,** Soc. de Cir. de Buenos Aires Bol. y Trab. 37:625, 1953.

A case is reported of adenoma of the liver in which, eight years after surgical removal, multiple tumors and amyloidosis were observed in the liver by surgical exploration and in the kidney by clinical study, without any history to suggest the condition. The literature on the subject is reviewed and the tumors commented upon.

**Rivas Diez, B.: Broncho-Biliary Fistula of Hydatid Origin,** Acad. argent. de Cir. Bol. y Trab. 37:574, 1953.

This is a short report on a patient operated on by the author after profuse bilioptisis, demonstrating a hepatobronchial communication borne out by roentgen study. The operation, which was followed by cure, is briefly outlined.

**De La Vega, C. A.: The Portal System.** Acad. argent. de Cir. Bol. y Trab. 37:528, 1953.

The author brings the subject up to date. In his opinion he is the first to have used pyelophlebographic methods experimentally in the Argentine. The procedure is fundamentally important to understanding of portal hypertension and its treatment.

After a minute revision of the subject, the author dedicates a chapter to the surgical aspect of the problem. He favors Saunders's transverse incision; exploration and pyelophlebographic examination; enlargement of the incision to one side of the thorax; vascular anastomosis, control pyelophlebographic study and suture.

**Sosa Gallardo, C. A.: A Critical Study of the Various Techniques for Surgical Bile-Duct Manometry,** Soc. de Cir. de Cordoba Bol. y Trab. 4-5-6-7:100 June-July 1953.

The Mallet-Guy, Caroli, Roux and Le Canuet, and Fogliatti technics are reviewed and criticized, and objections to their use when the patient has stones are considered. The methods are of value when there are functional disturbances of accessory bile ducts.

When lithiasis is present these technics are objected to because, apart from difficult, they offer no advantage over the impression obtained by clinical procedures and the certainty attained by operative cholangiographic study.

**Magistocchi, L. A., and Aguirre, J. A.: Transcutaneous Cholangiography,** Orientacion Medica 68:414 (Dec. 25) 1953; Soc. de Cir. de Buenos Aires Bol. y Trab. 37:666, 1953.

The authors report a limited but positive experience in the use of transcutaneous cholangiographic procedures when diagnosis was difficult and operation risky without the corroboration of this method, which has given them the certainty of roentgen diagnosis to support medical examination before operation. From the experience of others and their own, they state that the method is very simple and—much more important—harmless to the patient, who has to put up with no more discomfort than is involved, for example, in an excretory pyelographic examination.

The technic is described and 3 cases observed by the authors are reported, with reproduction of 10 cholangiographic studies. In the authors' opinion the method will be found indispensable in many cases; its indications are precise, and it will be valuable as an aid to the classic methods of diagnosis in solving complex syndromes of the bile ducts, both intrahepatic and extrahepatic.

***De Nicola, C. P.: Intravenous Cholangiography,*** Soc. de Cir. de Buenos Aires Bol. y Trab. 37:592, 1953.

Opacification of gall ducts by means of the substances used in cholecystographic had not yet been obtained. Only in exceptional cases, after giving administration of Boyden's stimulant, had it been possible to make the cystic and common ducts visible. Surgical cholangiographic investigation had been the only known procedure. The creation of SH 216, therefore, which allows cholangiographic study by the intravenous route, is a real advance.

The composition of the drug, its characteristics, the technic of its use and its advantages are described. It is quick (the gallbladder is opaque two hours after injection). But its greatest virtue is that the drug makes it possible at the time to obtain opacity of the hepatic, common and cystic ducts even in cholecystectomized patients. If the gallbladder and the ducts are not opacified, one can be certain that disease is present. In excluded gallbladders and those not opacified *per os*, SH 216 obtains opacity. The drug requires no preparation of the patient.

**Acerbal, J., and Massarelli, A.: Congenital Anomalies of Gall-Bladder; Agenesia; Double Gall-Bladder,** Bol. Soc. de Cir. de Rosario 20:89, 1953.

Anomalies of the gallbladder are rarely encountered. In 1947, Gross collected 147 cases from the literature, though his research was not exhaustive. Many are of purely academic interest, but some require surgical treatment, so that it is necessary to be acquainted with them in order to decide at operation on the tactics and technic of choice, as in the presence of double gallbladder and malposition. The embryologic background of the gallbladder is outlined, and agenesia and double gallbladder are commented on, with examples from 2 cases investigated by the authors.

**Marchese, M. J., and Viqueira Casal, J.: Flat Cell Epithelioma of Gall-Bladder; Cholecysto-Duodenal Fistula,** Arch. Argent. de Enferm. d. Ap. Digest 28:49, 1953.

The case of a patient with epithelioma of the gallbladder is reported. This tumor is rarer than adenocarcinoma. The following comments are made:

"This is a case for the already well-trodden paths of early diagnosis. The patient had a history of gallstones but had been examined neither by tube nor by roentgen ray. The disease ran its course and pain became constant, followed by bleeding in the higher portion of the digestive tract and evident worsening of general health. Then signs appeared of a tumor in the right hypochondrium. Proper treatment might have prevented development of the tumor or nipped it in the bud." In consequence, the authors arrive at the following conclusions:

1. Operation is the only treatment for cancer of the gallbladder.
2. The prognosis of cancer of the gallbladder is pessimistic.
3. Early diagnosis is the only hope of cure or even temporary relief.
4. Epithelioma of the gallbladder is preceded by metaplasia.

**Abramor, J. A., and Ingber, E.: Echinococcus of Gall-Bladder and Nephropathy in a Case of Situs Viscerum Inversus Totalis,** Semana med. 104:107, 1954.

All the viscera of the thorax and abdomen occupy the opposite side of the cavity, giving a mirror-image of normal conditions. This is the extreme expression of inverted symmetry, which begins with left-handedness and double hair-whorls in the scalp.

Known cases of this anomaly are reviewed, and the theories that attempt to explain it are discussed. The history of 1 case observed by the authors is recounted, in which tumor of the gallbladder and nephropathy were diagnosed in a patient all of whose viscera were inverted. The patient was sent to a surgeon who opened the left hypochondrium and removed the gallbladder, together, with a hydatid cyst. Incidentally, a Weinberg-Cassoni test, correctly performed, gave negative results.

**Gondra, M. D.; Urien, I. D., and Iturrioz, T.: Gall-Bladder on the Left Side,** Prensa med. argent. 41:124, 1954.

A new case of gallbladder on the left side is reported, and some earlier cases are analyzed. From a review of the literature, it appears that this is the first case observed in the Argentine and the seventeenth in the world. The authors who have written on the anomaly in question are listed.

Since there is nothing in the symptoms of disease affecting a gallbladder to [illegible] that it is on the left side, it is [illegible] routinely to take cholecystograms [illegible] plates before diagnosing excluded [illegible] der when the roentgen plates that show the right hypochondrium fail [illegible] abnormality.

The authors remark in closing that the presence of an abnormally wide falciform ligament may hide an ectopic gallbladder from a surgeon who uses the classic incision for bile ducts, thus inducing erroneous management.

**Ferracani, R. S.: Plastic Surgery of Bile Ducts with Vitallium Tube: End Results,** Soc. de Cir. de Buenos Aires Bol. y Trab. 37:685, 1953.

A roentgenogram is presented showing a vitallium tube in a patient aged 41, operated on eleven years earlier for an accidental injury to the bile ducts; a plastic operation over a tube of vitallium was performed, and, in spite of the lapse of time, there have been none of the difficulties that complicate plastic operations on the bile ducts, such as obstruction of the guide tube or elimination, whatever its nature or the technic employed.

The same patient was operated on later for eventration, and it was thus possible to check on the hepatobiliary conditions, showing elimination by duodenal tube of abundant bile, macroscopically and microscopically normal, with a normal hepatogram.

**Christmann, F. E.: Biliary Dyskinesia,** Prensa med. argent. 41:833, 1954.

The author states that in the past five years he performed 96 papillotomies on 595 patients operated on for extrahepatic bile ducts, for divers causes and using different technics. In several instances there was pure dyskinesia; the majority of the patients had gallstones. They have been followed up. The author has had 89.7 per cent of good results from papillotomy, so that his unfavorable results have dropped to 10 per cent of operations on bile ducts, confirming the view that biliary dyskinesia is an "anatomofunctional" disturbance of Oddi's sphincter that may be corrected surgically by papillotomy.

**Ferracani, R. S.: Accidental Section of Bile Ducts; Lahey Repair,** Soc. de Cir. de Buenos Aires Bol. y Trab. 37:679, 1953.

The author reports results a little over a year after operation on a woman on whom Lahey's procedure for repair of bile ducts was performed and the common duct was accidentally severed during cholecystectomy. The operation and postoperative course are described.

**Etcheverry, M. B., and de la Vega, C. A.: Benign Epithelial Tumours of Extrahepatic Bile Ducts,** Arch. Argent. de Enferm. d. Ap. Digest. 28:39, 1953.

A report on 2 observations of benign tumor of the extrahepatic bile ducts, both affecting the gallbladder, is presented. Three bibliographic lists are included.

The advantages of a uniform nomenclature are emphasized. The difficulty of clinical diagnosis is pointed out, and the use of agents permitting preoperative roentgen study of the bile ducts is encouraged.

**Yodice, A.; Le Chiare, F., and Pasman, H. R.: Cancer of Head of Pancreas,** Semana med. 104:265, 1954.

The authors report their personal experience with tumors of the head of pancreas, excluding the body, tail and Vater's ampulla. This experience led them to the following conclusions:

1. As with any cancer, if operation is to be successful and the patient to survive for any length of time, diagnosis must be prompt.
2. Diagnosis of cancer of the head of the pancreas is difficult. Its presence may be presumed when jaundice of more than a month's duration appears in a male patient without previous history of biliary disease.
3. Only tumor cells in the duodenal fluid can certify the diagnosis.
4. Diagnosis at operation is made by biopsy of neighboring glands of the consistency of shot, or by deep biopsy of the pancreas.
5. Operation may be performed in one stage if the patient is young and jaundice has not been present for much more than a month.
6. In the remaining cases, if jaundice does not improve with duodenal sounding and bilirubinemia is not diminished, operation should be performed in two stages.

### NEUROLOGIC SURGERY

**Fracassi, H.: Comments on the Paper "Remarks on the So-Called Parietoprefrontal Bundle Described by Professor Fracassi," Which Bears the Signatures of Prof. Raul Matera, Diego Outes, and Auturo Carrillo,** Prensa med. argent. 41:134, 1954.

As the title suggests this paper is a reply to the aforementioned authors in connection with a paper they published on the subject (Rev. Cap. Argentino 2:168, 1953). Its purpose is to remove doubts that might arise in the reader's mind, inducing those who practice the surgical treatment of pain to doubt the existence of the bundle described by the author, thus depriving their patients of a surgical resource as humanitarian as it is efficient. He gives proof of the bundle's existence, its functional importance and the effectiveness of its section, showing that it has never before been identified by any investigator.

The author demonstrates also that the arcuatum described by others is completely independent of his parietoprefrontal bundle, that tractotomy by the technic he suggests produces instantaneous suppression of pain. He urges colleagues to try it so that they may judge of its results.

**Carrillo, R.; Matera, R. F., and Perino, F. R.: Subdural Hematomas in Geriatric Medicine,** Archivos de Neurocirugia 9:220, 1952; Orientacion Med. 71:453 (Jan. 8) 1954.

Six cases of subdural hematoma in aged patients are reported, and the clinical characteristics of such hematomas are studied. From the authors' observations the following conclusions are drawn:

With chronic hematomas trauma may be negligible. The lucid period lasts days or months; attention is drawn to predominating mental disturbance which may be taken, if it is alone, for a sign of senility. In other cases hemiplegia appears, and if the patient is hypertensive, arteriosclerotic or subject to vascular disease it may be confused with softening of the brain. Finally, the condition may run a course similar to that of brain tumors.

In all cases, careful questioning, simple roentgenograms and especially pneumoencephalographic and ventriculographic study lead to correct diagnosis.

A simple operation with two trephine holes performed with the aid of local anesthesia, is usually sufficient to evacuate the hematoma and bring about the patient's complete recovery.

**Pereyra Kafer, J.; Rolla, E. H., and Poch, G. F.: Subdural Spinal Abscess,** Prensa med. argent. 41:98, 1954.

The authors report the eighth case registered in the world literature of subacute subdural spinal abscess. Autopsy documents are included.

The material available on the subject is discussed and a classification suggested.

**Albertengo, J. R., and Garrote, L. O.: Tumours of Temporal Lobe; Clinical Diagnosis,** An. de Cir. (Rosario) 18:18, 1953.

The possibilities of clinical diagnosis of pure temporal tumors are considered. The paper is divided into four parts. In the first, the embryologic, anatomic and histologic aspects of the temporal lobe are studied. In the second, recent advances in neurophysiologic knowledge of the temporal lobe are reviewed. In the third, the authors refer to the histologic types, frequency and origin of tumors of the temporal lobe. In the fourth they study the signs and symptoms, in order of importance, that lead to diagnosis.

**Matera, R. F.; Insausti, T.: Perino, F. R., and Udvarhelyi, J.: Cartoid-Cavernous Fistula; Clinical and Arteriographic Study; Surgical Treatment,** Archivos de Neurocirugia 9:206, 1952.

In connection with 4 traumatic cases, the authors consider definition, etiologic factors and physiopathic aspects; they insist on the existence of the circular sinus, which would explain double pulsating exophthalmos, the contralateral more intense, and the contralateral alone if the ophthalmic vein on the fistulous side is thrombosed.

Arteriographic studies were performed, and the authors point out the angiographic features of the condition, emphasizing visualization of the cavernous sinus and its venous tributaries and the importance of bilateral angiographic study before surgical procedure is undertaken. Each of the 4 cases is discussed individually.

Treatment and its grounds are outlined. It should aim at thrombosis of the fistula. Two of the patients underwent Brooks operation, and results up to the time of writing had been satisfactory. The authors consider the operation performed by Zeller (1911) ideal—ligature of the carotid artery in the neck, in its intracranial portion, at the point where it leaves the cavernous sinus, and obstruction of the ophthalmic artery.

**Marottoli, O., and Didier, A.: Nervous Lesions in Synovial Cysts,** An. de Cir. (Rosario) 18:49, 1953.

This is a general discussion of tenosynovial or arthrosynovial cysts, also called ganglions, which develop near limb joints, particularly on the dorsal aspect of the wrist. The cause of these lesions is not clear, though trauma is admittedly important. The lump is usually the only manifestation of this benign and common condition; on the rare occasions when pain is produced, it is circumscribed to the lump or at most is connected with some chronic or associated joint trouble. However, on occasion, in certain locations and under special anatomic conditions, it may compress a nervous trunk and give rise to varying neurologic symptoms.

Earlier papers on the subject are reviewed, and the cases of 3 patients with evident neurologic symptoms due to compression by synovial cysts, 2 of the wrist and 1 of the knee, are reported. The paper closes with remarks on the clinical picture, observations at operation and the postoperative course, not unlike those offered by other writers.

The only effective treatment is excision of the cyst, wherever it may be located, if it causes neurologic discomfort, and, as is usual in cases of neurodocitis, results will be the more satisfactory the earlier the nerve trunk is liberated.

**Quirno, N.; Defilippo, R. A., and Mieres, A.: Retroperitoneal Sympathocytoma,** Semana med. 104:311, 1954.

The history of tumors of sympathetic origin is reviewed. The histogenesis accepted by different authors is cited and the main features of these tumors outlined. The clinical and pathologic aspects assumed by those which are malignant by nature and a case of ganglioneuroma observed at autopsy in the left retroperitoneal region, between the adrenal gland and the kidney, are described.

**Nocito, F. J.: Sciatica from Hernia of Intervertebral Disc: Causes of Failure of Surgery,** Soc. de Cir. de Buenos Aires Bol. y Trab. 37:619, 1953.

The author reports a case of sciatica from herniation of an intervertebral disc in which surgical treatment failed owing to mistaken localization. Operation, after myelographic study, showed a disc hernia with calcification of the common posterior vertebral ligament, requiring sensitive radicotomy. In connection with this case, the author classifies causes of surgical failure and suggests means of avoiding them.

**Pereyra Käfer, J.; Poch, G. F., and Rolla, E.: Glomus Tumour — Angiomyoneuroma: Report on a Case with Microscopic Study,** Prensa med. argent. 41:331, 1954.

This clinical picture, which is easily diagnosed and surgically treated with constant success, is fairly frequent, 25 cases having been reported from the Argentine. A brief historical survey of the condition is given by the authors who remark that its acquaintance is very useful to neurologists and psychiatrists, as it may explain some types of peripheral pain.

A case is reported. Comment follows as to normal glomus and glomus tumors, with reference to national casuistics. From a study of the literature it is inferred that pain originating in a glomus tumor may be confused with certain peripheral or cordal neurologic and functional psychiatric syndromes.

The neuropsychiatrist who has to deal with one of these cases faces the following risks:

(a) The tendency to relate pain to a high lesion, neglecting peripheral exploration; (b) the danger of attributing the pain to the patient's psychic function and classing him as a neurotic, hysteric, malingerer, etc., and (c) confusion of the picture with that of causalgia.

For those who practice industrial medicine it will be useful to remember the possibility of a glomus tumor in patients who complain for a long time of very intense peripheral pain, with the features described, and connecting it with real or supposed trauma.

**Bardecci, C. A., and Christensen, J. C.: Multiple Meningioma of Malignant Course,** Prensa med. argent. 41:487, 1954.

Report on a case of cordal multiple meningioma with probable metastasis in the right pontocerebellar angle is reported. The tumor ran a rapid course, which is not common.

A microscopic study was made of the two tumors excised, and the prognostic importance of zones with young cells or mitotic cells is emphasized.

Prolonged radium therapy is considered to have been important in the characteristics of tumor in the case reported, as well as in its unusual course.

## OBSTETRIC SURGERY

**Luna, C. A. F.: Primitive Ovarian Pregnancy,** Prensa med. argent. 41:291, 1954.

After defining this condition as the pregnancy implanted and developed in the ovary from fecundation of the ovule on, the author analyzes the diagnostic conditions laid down by other writers and reviews the literature.

After discussing the etiologic factors, and pathogenesis, pathologic picture, symptoms and treatment (which is surgical), the author reports a case observed by him in which the four conditions demanded by Spiegeoberg were fulfilled:

1. The fallopian tube and ovarian fimbria were intact and separated from the ovary.
2. The ovum sac occupied the normal place of the ovary.
3. The sac was joined to the uterus by the ovarian ligament.
4. There was ovarian tissue in the wall of the sac.

In this case the tube was not excised, since it was totally separate from the ovary and its appearance was completely normal. The ruptured ovary alone was evidently diseased, and the author considered that it would have been an unnecessary mutilation for a young woman.

The pathologist's report confirmed the diagnosis of ovarian pregnancy.

**Baldi, E. M., and Perea, J. J.: Comparative Value of Methods of Inducing Labour: Experience at the Maternity Institute, Alvear Hospital,** Semana med. 104:138, 1954.

This is a brief outline of results obtained with divers methods from 1935 up to the present time. The authors do not dwell on technical details or the circumstances that indicate them. The indirect methods used were: Watson's; Abuerl's; administration of calcium-quinine and intraspinal injection of chloride solution; direct, and the use of an intrauterine catheter with antibiotic and antispasmodic medication—a modern version, so to speak, of Krause's old method.

The authors summarize their experience, saying that they have yet a long way to go before they obtain the perfect method of induction for rapidity and certainty of response, efficiency and harmlessness. Of those in use, they prefer Watson's (with preparatory use of estrogens, particularly in primiparae) among the indirect methods and the intrauterine catheter with penicillin and antispasmodics among the direct methods.

**Martini, J. L.: Viruses and Pregnancy,** Semana med. 104:244, 1954.

It can be said that a woman who has a virus infection during the early months of pregnancy is in more danger of having a baby with congenital anomalies than one who has not, especially if the infection was rubeola. The relation between rubeola and fetal malformation is borne out by statistics, experiment, seasonal fluctuation of fetal disease and the "embryopathic time-table." The calculated risk of having a deformed baby is 50 per cent for women who have rubeola during the first and second months; about 30 per cent for the third; 20 per cent for the fourth, and practically nil after the fifth. The most widely accepted pathogenesis is direct action of the virus on the fetus after passing through the chorionic barrier.

The consequence of virosis in the mother may be: (a) abortion; (b) premature labor or labor at term with stillbirth; (c) premature or full term labor with a deformed baby, or (d) premature or full term labor with a live baby showing signs of the mother's virosis. Gregg's syndrome consists of cataract, microphthalmia, deafness and malformations of the heart; it may be complete or incomplete and may be associated with other congenital malformations. In order to establish the condition as due to a virus, the mother's disease must have been proved. Prophylaxis consists of avoiding infection and of active and passive immunization.

The author denies that induced abortion is medically indicated. He does not consider it justified by social standards and points out that it is punished by our penal code, is against natural law and is condemned by the State Church. In short, the risk entailed by rubeola for pregnant woman must be combated by the joint action of several specialists for the maximum of success.

**Merchante, F. R.: Treatment of the Diabetic Gravida,** Semana med. 104:289, 1954.

The influence of pregnancy on diabetes and of diabetes on pregnancy and the baby is discussed. Reference is made to diagnosis of the disease during pregnancy and its treatment is outlined as: (1) diet; (2) administration of insulin; (3) general care; (4) gonad hormone therapy, and (5) obstetric management favoring delivery before term calculated in nearly every case, with a cesarean operation at eight to eight and one-half months in 70 per cent of the cases. Special care of the baby is also advised. The study includes 33 cases of pregnancy with diabetes.

There were 6 stillbirths (18.18 per cent) and 27 live babies (81.82 per cent). Twenty-four patients had cesarean section (72.72 per cent); 23 of the babies lived (95.83 per cent), and 1 died thirty-six hours after birth (4.17 per cent).

In 11 cases observed by the author, there were 2 normal deliveries with live babies and 9 cesarean sections with 8 live babies. Survival of 10 babies out of 11 is 90.90 per cent, although high doses of hormones, as suggested by other authors, were not used. That is why the author thinks his series may have been fortunate and is subject to improvement.

**Serantes, N. A.: Obesity and Pregnancy,** Semana med. 103:949, 1953.

A study of 31 obese gravidae assisted at the Department of Nutrition and Pregnancy of the Instituto Nacional de la Nutricion is described. In the patients' obstetric histories more abnormal pregnancies, a higher stillbirth rate, a higher neonatal death rate and a greater frequency of fetal gigantism were found. The figures are similar to those recorded for pregnancies in diabetic women in the prediabetic period.

Sugar metabolism is studied by means of fasting glycemia and diagnostic glycemia graphs. Comparison is made between two groups of patients, those who did and those who did not have treatment during their pregnancy. Fewer instances of toxemia and more normal deliveries occurred in the group of patients who had undergone treatment. There is apparently no influence of treatment on the babies' birth weight.

Possible physiopathologic mechanisms of alterations in obese gravidae are discussed.

## OPHTHALMIC SURGERY

**Salleras, A.: Indications and Contraindications for Keratoplasty,** Arch. Oftal. de Buenos Aires 28:498, 1953.

The author reports his experience on the subject, based on 172 laminary (70) or perforating (102) cornea grafts. In every case he studied the patient personally before and after operation and recorded the course, complications and end results, which he passes on that others need not make the same mistakes. It is his plan to write several papers on the subject; in this one he limits himself to the indications and contraindications of keratoplasty, the objects of which are: optical, tectonic, preparatory, cosmetic, therapeutic and refractive.

General indications and contraindications for the various varieties of graft (partial penetrating, total penetrating, and laminary) are reviewed. The author points out the favorable conditions for a corneal graft as follows: (1) keratoconus and familial dystrophies of cornea; (2) small leukomas, nonvascular, that may be completely included in the trephine hole; (3) extensive vascularized leukomas in which the deeper layers remain transparent, for in such cases the nutrition of the graft is maintained by the posterior layers; (4) absence or scarcity of vascularization, and (5) absence of other morbid conditions in the eye (glaucoma, synechiae, etc.).

He considers the following conditions unfavorable: (1) corneoconjuctival xerosis; (2) total or subtotal opacification with extensive vascularization; (3) the presence of other diseases (glaucoma, synechiae, etc.), and (4) certain acquired dystrophias (fat, Fuch's, of aphakia).

**Salleras, A.: Obtention and Preservation of Corneas for Keratoplasty,** Arch. Oftal. de Ba. A. 28:519, 1953.

The use of plastic material as a solution for the problem of grafting in highly sclerosed corneas must be rejected, because it is expelled after a short time, and recourse must be had to human material, since animal corneas have also failed.

The author describes the manner of enucleation and preservation of eyes, which is possible for as long as ten days, though the author is in favor of using eyes as fresh as possible.

However the corneas may have been preserved, it is most important for enucleation to be as early as possible and to operate immediately if practicable, thus ensuring the best results obtainable.

**Salleras, A.: Preparation of the Eye and of the Patient for Keratoplasty,** Arch. Oftal. de Bs. A. 28:535, 1953.

The eye on which keratoplasty is to be performed should be prepared so that only that operation is performed at the time. Circumstances, however, may demand the extraction of a lens subluxated through a trephine hole or section of an adhesion that thickness of the leukoma has prevented from being diagnosed before.

The author first outlines the care to be taken of the eye itself and then, in greater detail, the preparation of the patient, which is quite as important as that of the eye. He discusses the drugs he uses for treatment before operation: Fenergan, compound Ergotamine, Luminal, Ampliactil or Largactil. He outlines premedication with all of the drugs listed, stating that many patients, after premedication, could be operated on after mere instillation of the local anesthetic, and that some could even do without that.

Diffuse block of the autonomous nervous system is obtained; the patient is calm, relaxed, oblivious to the outside world and insensible. The author calls this state "mitigated hibernation"; it lasts about forty-eight hours and greatly favors postoperative quiet. Some advice is also given about management immediately before operation.

**Salleras, A.: Technique of Perforating Keratoplasty,** Arch. Oftal. de Bs. A. 28:569, 1953.

As the title suggests, the several aspects of the operation are reported: anesthesia (by *instillation of 10 per cent cocaine each minute*), akinesia (curarization), separation of the eyelids with Roveda retractors; obtention of the graft; trephine of the host; the placing of the graft in position; suture; reconstruction of the anterior chamber, and bandaging.

**Erausquin, H., and Ferrer *Arata*, A.: *Traumatic* Foreign Body in Lachrymal Sac,** Arch. Oftal. de Bs. A. 28:446, 1953.

An unusual case is reported of localization of a metallic foreign body in the lachrymal sac, the traumatic nature of which gives originality to the paper. Surgical treatment was highly successful both technically and functionally, for the symptoms disappeared and the patient returned to normal.

**Malbran, J. L.: Lacrimal Intubation: A New Technique; Preliminary Report,** Arch. Oftal. de Bs. A. 28:512, 1953.

Although the author is not necessarily opposed to dacryocystorhinostomy, he holds that this operation cannot be considered the final solution to the frequent problem of lacrimation and chronic dacryocystitis. It is too much of an operation for the trouble it sets to rights, and it is not foolproof; moreover, it is technically difficult. These facts have directed lacrimal surgical technic toward what may be generically termed lacrimal intubation.

The history of this form of management is reviewed and the author's technic described. The latter differs in general from others in that, instead of seeking to introduce the tube through an opening made on the anterior wall of the lachrymal sac, it favors introduction of a polyethylene tube as a complement to stricturotomy, in the manner comprehensively described by Poulasrd and his disciple, Bastan.

**Pereira, R. F.: Use of Diathermic Electrocoagulation in Dacriocystorhinostomy,** Arch. Oftal. de Bs. A. 28:575, 1953.

The author relates his experience with electrocoagulation. He employed the diathermic procedure he saw Barraquer Moner use, in order to avoid layer bleeding during the operation, which is an obstacle to rapid work. The technic used to surmount certain obstacles is described. The author states that he has not followed Barraquer Mora in the use of hexamoehonium as a hypertensive agent which makes it possible to operate on a bloodless field, with a maximum blood pressure of 7 millimeters of mercury.

**Zambrano, J. C.: Eye Lesions from Copying *Pencil: Contribution to Their Treatment*,** Arch. Oftal. de Bs. A. 28:475, 1953.

The serious nature of the damage done by introduction of particles of copying pencil or aniline dye into the eye is well known; the action is caused by the chemical composition of the coloring material used in their manufacture, which acts by chemical disintegration, is easily diffusible and affects selectively the cell nuclei, with necrosis of tissue.

The author reports 3 cases of his own, 2 managed medically and the third requiring operation for a small perforating wound at the inner angle which affected the conjunctiva and the subconjunctival layer.

**Cambiasso, R. H.: Ocular Ochronosis with Alcaptonuria and Osteoarthritis: Personally Observed,** Arch. Oftal. de Bs. A. 28:456, 1953.

A case is reported of alcaptonuric ochronosis with its characteristic triad: pigmentation of the sclera and cornea, alcaptonuria and osteoarthritis deformans. This is the first case to appear in the Argentine ophthalmologic literature, but it is the seventh reported case of alcaptonuria observed in the country.

Changes in the locomotor system, urinary alterations, changes in conjunctiva, cornea and ochronosis 70 of which were directly consulted, are quoted as references.

**Lagos, E. J. J.: Concerning Tumors of Limbus and Adnexa of the Eye,** Arch. Oftal. de Bs. A. 28:385, 1953.

Biopsy should be performed on all tumors of the sclerocorneal boundary and of adnexa of the eye. If the growth proves malignant early excision is indicated. Contact roentgen therapy is preferred for epithelioma. Tumors of the sclerocorneal ring should be tangentially irradiated to avoid irradiation of the lens. Patients should be followed up for some time to make sure there are no belated manifestations. If necessary, roentgen therapy should be repeated three months later.

**Roveda, J. M.: Congenital Bilateral Cysts of Vitreous: Report of a New Case,** Arch. Oftal. de Bs. A. 28:399, 1953.

Cysts of the vitreous body are so rare as to be ophthalmologic curiosities. Excluding those caused by parasites and retinalpathologic conditions, the author has found only 43 cases reported in the world literature. He includes prepapillary cysts, which are usually included among malformations and alterations of the papilla and not among those of the vitreous. This classification considerably increases the number.

A chronologic list of references is given, and the author reports his case, in which the lesion was probably attributable to hyaloid remains in the posterior region. These remains, which are often observed in the newborn on the nasal side of the papilla, might under special circumstances give rise to cysts which, in typical cases, like the one in point, have just that location. Similar cases have been published.

**Abravanel, R., and Morate, F. H.: Osteoma of Orbit,** Bol. y Trab. de la Soc. Argen de Cirujanos 21:630, 1953.

This tumor is benign in itself, but may cause serious complications by its growth. Its origin is uncertain.

Eburneous osteomas are the most frequent; they are usually pediculate. Their volume and weight vary; there is usually only one, springing from the orbital wall or some neighboring cavity. One per cent of the patients remember a trauma.

The objective symptoms are slow growth, intractable lateral exophthalmos and a hard tumor, without changes in circulation, which produces chemosis only in the latest stages.

The treatment is excision; the most important phase is fracture of the pedicle as advised by Argararaz.

Differential diagnosis should be made from: sarcoma (pain and circulatory changes); syphilitic exostosis (pain, particularly at night); chronic sinusitis (history, roentgen rays) and vascular tumors (soft and reducible).

## ORAL SURGERY

**Jorge, J. M.: Presentation of a Patient Operated Upon Twenty-Six Years Ago.**

In 1927, when the patient was 19 years old, the author operated on him for a sarcoma of the soft palate. Both a photograph taken at the time and the patient himself were shown; now he wears the prosthesis put in at that time, which has allowed him to lead a completely normal life. This patient also had pulmonary tuberculosis, the bacilli having been observed in his sputum, and he had been radically cured of that disease.

## ORTHOPEDIC SURGERY

**Carnevale, V.: Some Generally Useful Resources in Traumatology and Orthopedics,** Prensa med. argent. 49:3542, 1953.

This paper is a brief study on the use of hyaluronidase in orthopedics. The origin and dose of the drug are outlined and its use recommended when large quantities of liquid are injected subcutaneously, since it accelerates absorption. The addition of hyaluronidase to hypertonic solutions and plasma diluted in one-half to one-third volume of isotonic dextrose is recommended when it is desired to replace the intravenous route with the hypodermic.

With regard to anesthetics, quicker anesthesia over a wider field, and without a latent period, is obtained, which enables the operation to begin more promptly. With nerve trunk or ganglion block there is no need to localize the element aimed at very precisely; it is enough to infiltrate the adjacent zone.

Other possibilities, such as treatment of fracture of the lower end of the forearm, fracture of the hands and fingers, Volkmann's disease, hemorrhage into soft tissues, the hematomas of arthrodesis and any operation on a joint, bone graft donor zones, small fractures and suppurating arthritis, are discussed.

**Carnevale, V.: Some Generally Useful Resources in Orthopedics and Traumatology,** Prensa med. argent. 41:132, 1954.

After publishing an earlier paper on the same subject (see above), the author analyzes ultrasonic waves and summarizes the most generally known and accepted effects: (a) hyperemia, (b) antiphlogistic effect and (c) analgesic effect.

He considers the two manners of application, immersion and contact, and enumerates the ills in which ultrasonotherapy should be remembered, although it is not always effective whether alone or in combination with other forms of treatment.

**Slullitel, I.: Presacral Dermoid Cyst,** Bol. Soc. de Cir. de Rosario 20:99, 953.

This extremely rare condition has a limited place in the orthopedist's experience. In the case reported a complication, osteitis of the sacrum and coccyx, required the author's aid, thus allowing him to add 1 case to the scanty literature. He was unable to find a single reference to the condition in the Argentine literature.

Foreign publications on the subject are briefly reviewed and the characteristics of this type of cyst described; apparently they develop only in the female, no instance having been found in which the patient was male. They occur at all ages, especially between 20 and 50; the patient in the case reported was a woman aged 40.

The theories as to their origin are outlined and the pathologic picture described. The difficulties in diagnosis of all tumors of the presacral region are pointed out and analyzed. Treatment is surgical, and, as these cysts are all benign, it has always been successful when radical. Access is gained by the posterior route, for there may be obstacles to complete excision by the anterior, which does not allow access to the whole tumor; midline incision goes from the anus to above the coccyx, which is resected, together with a part of the sacrum, up to the second segment.

The history of the author's patient is given in detail.

**Marottoli, O., and Didier, A.: Supracotyloid Pseudocysts,** Bol. de Cir. de Rosario 20:150, 1953.

The authors report 6 cases of pseudocystic skeletal lesions of supracotyloid location and similar roentgen images. In all of them acetabular deformity of congenital origin and roentgen signs of subluxation of the hip were observed. In 4 there were associated signs of arthritis deformans. The clinical picture corresponds to that of chronic noninfectious condition of the hip joint.

The pathologic character of the contents of the supra-acetabular cavity was also similar in all cases. A constant observation was fibrosis, which underwent regressive changes ranging from mucoid degeneration to cavitation. Necrobiotic phenomena and serofibrinous exudation were also present. The pathogenesis of the condition is as yet uncertain.

The author's evidence is insufficient to allow them to decide whether such cysts should be considered signs of arthrosis in anomalous hips, or as an entity in the skeletal pathologic change present in the region.

**Ferández Vocosx, A.: Cyst of the External Meniscus of the Knee,** Soc. de Cir. Córdoba, Bol. y Trab. 4-5-6-7:117 (June-July) 1953.

Four cases are reported. The condition is a degeneration affecting the perimeniscal tissues and interfering only secondarily with the structure of the fibrocartilage itself. Pain is the predominating symptom, and a lump is the main abnormality observed on physical examination. According to the latest ideas, it would seem to be caused by friction of the popliteal muscle tendon against the edge of the meniscus when the muscle contracts. Treatment should be invariably surgical; the whole meniscus which is the seat of the trouble should be excised. Recurrence invariably follows removal of the cyst alone.

**Zarazaga, J.: Obstetrical Detachment of the Proximal Epiphysis of the Femur,** Soc. de Cir. Córdoba, Bol. y Trab. 4-5-6-7:130, 1953.

This is a separation produced during labor owing to maneuvers performed on the femur at the level of the conjunctive cartilage that forms the boundary between the head and the neck. The author briefly lists some papers on the subject, reports a case he has observed and comments on it. The treatment advised is to reduce the detachment by traction and inward rotation and slight abduction of the hip; this position is maintained by means of a plaster bandage for one to two months. Treatment should be prompt, as the periosteum rapidly proliferates and fixes the hip in outward rotation and flexion, which makes osteoclasia necessary.

The author concludes that obstetric detachment of femoral head is a morbid entity produced by manual extraction in the presence of podalic presentations or of version. It produces the symptoms of a fracture plus the roentgen image of incipient congenital dislocation of the hip.

**Imaz, J. I.: Osteochrondritis Desiccans of the Femoral Head,** Bol. y Trab. Soc. Arg. de Ortop. y Traumatol 7:204 (October) 1953.

A new case is reported. In the adult, according to the author, the condition exists long before any symptoms betray it. In the case reported, trauma may be ruled out as a cause. The author discusses the pathologic picture and the clinical course. He reviews the therapeutic procedures that have been suggested and gives a brief description of the operation he performed on his patient.

**Maróttoli, O.; Didier, A., and Celoria, F.: Our Experience in Arthroplasty of Hip with Acrylic Prostheses,** An. de Cir. (Rosario) 18:1, 1953; Bol. Soc. de Cir. de Rosario 20: 121, 1953.

Although results of arthroplasty with acrylics are encouraging, it is too early for definitive conclusions to be drawn, and also for overoptimism, as the longest follow-ups in orthopedic centers are not more than six years old. The authors mention some of the stages in development of the technic (fascia, vitallium and resection arthroplasty with interposition of acrylic material). They review the indications for arthroplasty, describe the operative procedure and end their paper with a general analysis of the results they have obtained.

They have operated on 25 patients, bilaterally in 1 case. There were no deaths. The only local complications attributable to the operation were gluteal cellulitis in 2 cases, which was cured by antibiotics; subluxation during the mobilization period in 1 case, orthopedically reduced, immobilized in plaster and later restored to normal. The age of the youngest patient was 10; that of the oldest, 74. There were 6 male and 19 female patients. The results in only 18 cases have been analyzed; the remainder were too recently operated on. The authors follow the classification suggested by Merle D'Aubigné for results, which considers the state of the hip prior to operation as well as pain, mobility and gait.

The results are tabulated under two heads, according to etiologic factors and according to treatment of the acetabulum. The authors state that, since their oldest patient is no more than twenty-one months from operation, it would be wrong to consider their results final, because the possibility remains that some of those classed as "good" or "excellent" may yet deteriorate, or some of the "middling" and "bad" results improve.

**Girardi, V. C., and Defilippis Novoa, C. A.: Arthroplasty of Hip with Acrylic Prosthesis: Route of Approach,** Prensa méd. argent. 41: 599, 1954.

The medial approach for arthroplasties of the hip with acrylic prostheses, in certain cases of fresh fracture of the femoral neck and pseudoarthrosis of the same is minutely described. It has the advantages of not mutilating, not dividing any muscle system, and affording more than enough exposure for the operation to be performed through a moderate-sized incision. The authors have used the technic in 6 cases and are satisfied with the results.

**Rivarola, J. E.: Congenital Dislocation of Hip,** Orientación Médica 63:377 (Dec. 18) 1953.

This is a meticulous study of one of the most difficult problems in orthopedics, as it has been said that "one knows when one begins to treat a hip, but neither when nor how the treatment is going to finish." The prognosis has improved with advances in surgical technic procedures and early diagnosis.

The author gives a rapid sketch of (1) pathologic changes; (2) clinical examination, including arthrographic study of the hip; (3) diagnosis, and (4) both medical and surgical treatment. As regards the latter, he discusses the diversity of technic according to the child's age and the circumstances attending the dislocation.

**Maróttoli, O. R., and Didier, A. E.: Arthrodesis of Wrist with Robinson and Kayfetz Technique,** An. de Cir. (Rosario) 18:99, 1953.

Though seldom used in orthopedic surgery, arthrodesis of the wrist is valuable for the treatment of divers conditions of the radiocarpal joint. In essence, the procedure is one that annuls an important function of the upper limb; however, it is well known that the resulting incapacity is but slight. Functional results may mean the sacrifice of one joint, which indirectly favors recovery of the complex functional value of the hand.

Divers technics are reviewed and their pros and cons discussed. In order to avoid some of the disadvantages, Robinson and Kayfetz devised a new method of obtaining quicker and surer fusion; this consists of excision of the first carpal row and fixation of the osteum majus to the radium by a screw. Thus they set surfaces composed of porous bone opposite each other, with normal vitality and considerable osteogenic power.

The authors relate in detail the advantages they attribute to their method on the basis of 12 cases, in all of which complete arthrodesis was obtained in not more than eight weeks. The technic is described, and the histories of 2 patients operated on by the authors are given, with roentgenograms. The authors maintain that resection of the distal end of the ulna does not upset the anatomic structure of the wrist or the physiologic status of the radiocarpal joint, but favors partial or total recovery of pronosupinator function.

**Jorge, J. M.: Traumatic Amputation of Both Arms; Possibilities of Useful Upper Limb Prosthesis,** Soc. de Cir. de Buenos Aires Bol. y Trab. 37:675, 1953.

The author presents the case of a girl aged 17 who lost both arms in an accident at work when she was 10 years old. The possibilities of the stumps are discussed, and the artificial limbs that have been made for them, by means of which many of the difficulties of this type of prosthesis have been overcome, are described.

**Matera, R. F.; Donnes A. V., and Miguel, M. A.: Arthrodesis of Lumbosacral Spine: Authors' Technique; Vertebral Intercorporal Fixation,** *Archivos de Neurocirugia* 9:230, 1952.

The common causes of sciatica and lumbosciatica are enumerated and the physiopathologic mechanism of low back pain explained, with emphasis on neuritis of Roofe's nerve and instability of the spine. The symptoms and signs of sciatica, spondylolisthesis and lumbosciatica from hernia of the nucleus pulposus are given.

The authors describe the type of file card they use in studying the lumbosciatic syndrome. They outline indications for arthrodesis in cases of sciatica. They mention the usual technics for arthrodesis of the lumbar part of the spine, and discuss them critically, before describing their own, vertebral intercorporal technique, which prevents the vertebrae from slipping forward.

The histories of the first 3 patients operated on are transcribed; they have been followed for four to five years, with most satisfactory results.

**Perruelo, N. N.: On Arthrodesis of the Spine,** Prensa méd. argent. 41:853, 1954.

The author contributes his experience with 133 cases to the statistics on the subject, from which he draws the following conclusions:

1. Albee's operation gives very good results; he is surprised that anyone should be opposed to it.
2. The lumbosacral zone is the critical part of the spine; intra-abdominal paraspinous grafts are useful. Bosworth's technic is of value in this region.
3. Correct, prolonged immobility is perhaps the most important factor in good consolidation of the arthrodesis block.
4. The posterior route solves nearly all cases.
5. Mixed arthrodesis (bone and metal) is not justified.

**Rivara, L. T.: Osteomyelitis in Childhood,** *Orientación Médica* 67:360 (Dec. 11) 1953.

The clinical picture and treatment of osteomyelitis in childhood—a condition that has benefited from recent advances in treatment to the point of radically changing its prognosis—are analyzed in the light of modern knowledge. The author says, in fact, that it is a "disappearing disease," owing in the first place to discovery of the bacteriostatics and in the second place to discovery of the antibiotics.

The disease is minu [illegible] all its aspects, and it is [illegible] re of medical treatment [illegible] operate (a rare [illegible] i-mal. Small incisions are made, with the patient under general anesthesia, and the abscess is drained. If an incision in the periosteum shows pus flowing from Havers' ducts, the bone must be trephined in four or five places (not laid open with hammer and chisel), the pus let out, a petrolatum gauze tampon inserted and the whole enclosed in a plaster boot.

In the days following this treatment, the boot is observed for staining; windows are cut at places where it occurs, and dressings changed at long intervals. The author has been using ilotycin, an antibiotic which is very active against staphylococci. The patient's general health is built up by careful feeding, and he is usually ready to leave the hospital after two weeks. Healing takes place in a short time, and only rarely does the condition become chronic.

### SURGERY OF EARS, NOSE, AND THROAT

**Chiodi, J. H.: Ozena and Its Treatment by Anesthesia of the Upper Cervical Sympathetic Ganglion,** Prensa méd. argent. 41:662, 1954.

Treatment of the autonomic nervous system by infiltrating the upper cervical sympathetic ganglion with an anesthetic for atrophic rhinitis or ozena results in temporary improvement, which may last as long as seven months. After infiltration the mucosa becomes humid, the scabs fall, fetor disappears and the subjective sensation of respiratory failure is relieved. In order to obtain improvement, alternate sides are infiltrated. Four infiltrations are usually enough. The effect appears to be partly direct, through improved trophism of the nasal mucosa, and partly indirect, by pituitary action.

The consequent nasal congestion does not produce bleeding, as does periarterial sympathectomy. Apparently tetraethylammonium bromide might replace that therapy.

Infiltration is advised for preoperative and postoperative treatment and for patients who cannot be operated on. Probably patients with incipient and slight involvement may be permanently cured by ganglionic infiltration.

**Dameno, E. (h): General Remarks on Pre- and Postoperation in Larynx Cancer Patients,** Prensa méd. argent. 41:861, 1954.

Examination and preoperative and postoperative care of patients with laryngeal cancer has prompted the author to write on these points in general, leaving particular problems for a later paper.

Examination seeks to determine the degree of extralaryngeal and humoral repercussions of the cancerous condition and the presence of other unrelated changes which may have weight in the postoperative period. After consideration of results of questioning, physical examination, laboratory tests and roentgen investigation, rational treatment is instituted on the understanding that operation, transfusion at operation, and general anesthesia are minor threats to the system already upset by cancer, representing a functional overcharge. The patient will overcome this attack or not, according to his previous condition. Thus preparation seeks not only to correct abnormalities already present but to prevent those which operation and its accessory procedures may bring about.

From the practical point of view, the ends pursued are to recognize, treat and prevent the following: repercussion of the disease on trophism: metastases; abnormalities of the heart and circulation; unknown diseases; abnormalities in general condition (malnutrition hypoproteinemia); infection; bleeding; dehydration; systemic complications; heart failure; arteriosclerosis, and chronic bronchitis with emphysema and diabetes. The tests routinely employed before the operation are outlined, and a suitable diet for the patient is included.

**Albertengo, A. G.: Plastic Surgery of Pharynx,** Bol. Soc. de Cir. de Rosario 20:86, 1953.

The author presents a patient who underwent laryngectomy for malignant disease of the larynx and later removal of a cancer of the esophagus. Excision was begun near the base of the tongue, and about 8 cm. of esophagus was removed. It was decided to attempt immediate repair for reconstruction of the pharynx, and the technic used is summarily described. The postoperative course has been excellent.

### SURGERY OF THE ABDOMINAL WALL

**Aguirre, C., and Goldin, J.: Treatment of Voluminous Epigastric, Hernias, and Supra —and Infraubilical Midline Eventrations with Welti-Eudel's Technique in Five Cases Personally Observed,** Prensa méd. argent. 41:274, 1954.

The Welti-Eudel technic for the treatment of epigastric hernia and midline eventrations is described.

Goñi Moreno's pneumoperitoneum is advised as a preparatory measure in voluminous hernia repairs and eventrations.

Five cases are presented, in which the results were good. The inner edges of the cut rectus anterior muscle sheaths were sutured with floss-silk sutures.

**Ferracani, R. S.: Postoperative Eventrations: Clinico-Surgical Remarks,** Prensa méd. 41:383, 1954.

The most important aspects of postoperative eventrations are reviewed on the basis of experience obtained from 148 patients treated in Ward xv of the Policlinico Rivadavia, with an analysis of the pathogenic factors, symptoms, and results of surgical treatment.

**Kaplan, S., and Rádice, J. C.: Desmoid Tumor of Abdominal Wall,** Prensa méd. argent. 41:736, 1954.

A fibrous lump in the abdominal wall of a 47-year-old woman is discussed. The mass had the characteristics of desmoid tumors; these are invasive fibromas of benign microscopic structure which invade and force apart the muscle fibers of the anterior abdominal wall. In this case the growth included the round ligaments and had formed close adhesions to the bladder and uterus. Such tumors are roentgenosensitive and not metastatic.

The radical operation performed is described.

**Schena, A. T.: Chronic Omentitis,** Arch. Argent. de Enferm. d. Ap. Digest. 28:43, 1953.

As the author has had occasion to treat 2 new patients, 1 of whom was going through an acute episode, and since the pathologic conditions affecting the omentum majus (torsion, infarction, omentitis, tumors, etc.) are seldom observed, he thinks that a few comments on the subject may be of interest.

The history and the operation performed in each case is described and commented on. It is noted that the conservative treatment applied in both was followed by favorable developments. The fact is the more interesting in Case 1, since the disease was in an acute stage when the patient was operated on. Excisions of omentum are in order for localized conditions—infarction, torsion, omentitis in hernia, free omentitis, etc. Wide or limited excision for chronic omentitis should be kept for mechanical complications, such as may be occasioned by omental adhesions.

**Di Rienzo, S.: Roentgen Therapy for Omentitis,** Orientación Médica 68:385 (Dec. 18) 1953.

An apparently unprecedented treatment for omentitis, consisting of irradiation of the abdominal wall according to special technical rules, is proposed. Records shown by the author indicate that the results are excellent.

The technic, indications and contraindications are described. The treatment is in order for any acute or subacute type of omentitis, whatever its cause. It should be used after operations in which a "plastron" has been observed, or in the treatment of patients who have been previously operated on and in whom adhesions have formed.

In this connection the irradiation is prophylactic. The main contraindications are intestinal perforation and hemorrhage.

In women, the pelvis minor must be irradiated with medium doses or castration will supervene, though low doses produce only ovarian excitation.

## PLASTIC SURGERY

**Albertengo, A. G.: Flat Skin Pedicles,** An. de Cir. (Rosario) 18:57, 1953.

In this paper the pros and cons of pedicle grafts are meticulously discussed, and the three main methods and their respective technics described. Several schematic drawings and photographs from the authors' case records are presented.

**Niklison, J.: Surgical Repair of Facial Paralysis: Muscular Plastic Operations,** Bol. y Trab. de la Soc. Argent. de Cirujanos 22: 666, 1953.

The treatment described is based on a study of anatomy and function, which the author divides into regional and functional complexes. This is followed by a physiopathologic study of the region, which is the basis of clinical evaluation. Changes may be detected and identified and procedures chosen on that basis.

Three corrections are established; static, dynamic and contralateral. A technic of the author's for shortening the frontal muscle is given. Another is published for the first time, which is employed for correction of the nostril, upper lip and commissure. A technic for the transplantation of the masseters and temporal muscles is outlined.

The need for correction of the healthy side is pointed out, and a technic for section of the elevator proprius labri and the zygomaticus majus muscles is described.

**Maróttoli, O. R., and Albertengo, A. G.: The Use of Skin Grafts in Treatment of Chronic Osteomyelitis,** An. de Cir. (Rosario) 18:91, 1953.

The authors report their experience with this procedure. They have been encouraged by the results and intend to apply the method extensively in order to collect a statistically significant number of cases.

Their point of view on the role of free grafts in the treatment of this chronic condition is explained.

**Sgrosso, J. A., and O'Connor, C. M.: Treatment of Non-Consolidated Fractures of Leg with Insufficient Skin Covering,** Prensa méd. argent. 41:107, 1954.

One of the problems a plastic surgeon most frequently has to solve especially in legs, is that of ulcers of divers sorts. The authors consider in particular those fractures of the lower third of the leg which fail to consolidate and are poorly covered by skin. They are usually old exposed fractures, slow to heal; the skin on the inner aspect of the leg has been replaced by an extensive, atrophic, cyanotic scar, with ulcerations which may close after a lengthy secondary epithelization process and reappear complicated by an infection. Such a feeble covering is no solution and may even make the problem more complex than it was.

Treatment involves excision of the scar and the substitution of healthy skin, so that attention may be next turned to the bone. Free grafts are not advisable. The authors list the procedures advised, with their pros and cons. They are: (1) pedicle graft obtained by sliding from the same leg; (2) pedicle graft from the opposite leg (cross-leg); (3) open jump pedicles from the abdomen, with the forearms used as intermediaries, and (4) tube pedicles from the thigh or the abdomen, with the wrist used as an intermediary.

Each of these types of pedicle graft is described. The histories of 2 cases observed by the authors are transcribed.

## THORACIC SURGERY

**Trigo, E. R.: Flow from the Nipple,** Orientación Méd. 67:371 (Dec. 11) 1953.

This article is a doctor's thesis analyzing mammary exudate, which has received divers names; the author proposes the one given in the title of his paper. The flow may be of blood, milk or other fluid.

The author reviews the interpretations of this phenomenon given by different writers from antiquity up to the present day. Mammary anatomic and physiologic backgrounds are summarized, and the physiopathologic nature of the flow, which may result from parietal or extraparietal causes, is explained. It is pointed out that flow from the nipple is invariably an index of a morbid condition of the gland and must guide diagnosis. There are clinically two main groups: (a) flow with palpable tumor and (b) flow without palpable tumor. Each type is discussed with statistics from 50 cases personally observed: dendritic adenoma, 42 per cent; cancer, 12 per cent; cystic disease, 6 per cent; dilated ducts under the nipple, 8 per cent; inflammation, 6 per cent, and morbid conditions of the male breast, 4 per cent. The flow in 70 per cent of cases was blood, in 30 per cent other fluids. There were 52 per cent with palpable tumor and 48 per cent without palpable tumor.

The surgical or medical treatment applied in several cases is described. Surgical treatment was used in 32 cases, medical treatment in 11. Seven were incompletely studied. Recidivation or flow from the other breast occurred in 16 per cent.

**Moguilevsky, L., and Eguia, O. E.: Venous Invasion in Breast Cancer,** Prensa méd. argent. 41:739, 1954.

Venous invasion and its relation with age, the time lapse since development began, gland invasion, the menopause, the size of the tumor and the hystological picture were studied in 32 samples of mammary cancer obtained at operation.

Veins had been invaded in 59.3 per cent of the cases. The relation with age, duration of tumor and histologic picture was evident. Venous invasion is greater in young patients and less in women at the menopause, in inverse ratio to the age of the tumor.

Venous invasion is independent of invasion of lymph glands and the size of the tumor but is connected with the histologic picture —commoner in adenocarcinomas (71 per cent; nil in scirrhous tumors).

**Moguilevsky, L.; Eguia, O.; Molieri, I. J., and Orsini, W.: Nine cases of Sarcoma of Female Breast Followed Up for 5 Years,** Bol. y Trab. de la Soc. Argent. de Cirujanos 25: 195, 1953.

After general comments and reports of 9 case histories, the authors' observations are summarized as follows:

Primitive fibroblastic sarcoma, 5; growth developing as phyllodes tumor, 4; adenofibromyxosarcoma, 2; fibroblastic sarcoma, 1, and polymorphic gigantonuclear sarcoma, 1. The patients were aged 27, 29, 30, 35, 45, 47, 52, 58 and 66 respectively. One died at operation and 1 a few months later, of pulmonary metastasis, but it is pointed out that this patient was in poor general health and beyond operability. Of the 7 remaining patients, 1 lived four years and 1 two years; both were operated on a second time. Five were alive and well five years later, on only 1 of whom mastectomy, followed by roentgentherapy, was performed. Halstead's operation was performed on the remainder.

The authors conclude that sarcoma of the female breast is a tumor that should be treated by Halstead's original operation. When these tumors are diagnosed in time the prognosis is much more favorable than that of carcinoma. Not partial operations but Halstead's original amputation should be performed. Irradiation is in order only for reticulosarcomas and lymphosarcomas.

**Halpérin, A., and Markman, I.: Thymus Tumors Thymomas,** *Prensa méd. argent.* 40: 3520, 1953.

The authors contribute 1 case to the literature. Physical examination and especially roentgen study, point to the anterior mediastinum and often give a precise diagnosis. The authors mention the comparative harmlessness of thoracotomy under normal conditions and conclude that for thymomas, as for all endothoracic tumors, early surgical exploration is a "must." They consider the posterolateral incision the best route of access, owing to the wide field of action it allows the surgeon.

**Puyó Villafañe, E.: Hiatus Hernia,** Semana méd. 104:147, 1954.

Approximately 10 per cent of contrast roentgen studies of the digestive tract reveal hernia of the esophageal hiatus when the region is studied systematically. The figures given by divers authors are briefly reviewed, some of whom considered the small hiatus hernias physiologic in the aged. Of the three types mentioned by Akerlund—congenitally short esophagus, paraesophagic hernia and esophagogastric hernia—only the two last named are of interest from a surgical point of view in the adult, because the former is not a true hernia. Each type is briefly described, and it is pointed out that differentiation between the two at operation may be very difficult, even when contrast roentgenograms are taken with the patient in various postures.

The pathogenesia of hiatus hernias is analyzed, and the opinions and statistics of several workers who have made a study of the subject are cited. The symptoms and the positive and differential diagnosis of these hernias and their varieties (essentially roentgenographic) are described. From the point of view of treatment, there are three possibilities: (1) small hernias usually diagnosed by chance or on roentgen examination, with few or no symptoms, which require no treatment; (2) moderate-sized and troublesome hernias requiring medical treatment and regulation of diet and body weight, and (3) hernias requiring surgical intervention because of their size and symptoms after failure of conservative treatment, considering that they often become complicated.

Some details of the technic of operation are outlined, and the paper closes with an abridged version of the case history of 1 of the author's patients.

operative day and left the hospital on the eighth day, when the stitches were removed. A hematoma (100 cc.) was evacuated on the twelfth day.

**Quereilhac, H., and López Rinaldi, A. J.: Diaphragmatic Hernia Through Morgagni's Hiatus,** Arch. Argent. de Tisiol. 29:131, 1953.

After brief reference to the better known diaphragmatic hiatuses, the authors study Morgagni's hiatus at length and describe in detail the roentgen observations in 4 cases of hernia through this hiatus.

**Bernardi, A. J.: A Case of Megaesophagus and Epicardial Diverticulum,** Prensa méd. argent. 41:119, 1954.

The authors report a combination that does not appear to be frequent in the literature.

**Gil Mariño, J. A.: Esophagoscopy and opsy in Diagnosis of Pathology of the ophagus,** Prensa méd. argent. 40:3509, 953.

Considering the potential dangers of esophagoscopy and biopsy, the author is convinced that they are unnecessary in many cases and should be kept for those in which physical examination and roentgen study give doubtful results, and in which they may be decisive. Divers aspects of the subject are analyzed, and it is noted that the main object of the paper is to publish the experience obtained by a medical and surgical team working on disease of the esophagus, a combination the author considers peculiarly free from error. The general surgeon is unfit to solve the problems single-handed and should pass the patient on to those who specialize. Disregard of this rule has lost many a patient his chance of operation, merely because the physician or surgeon treating was satisfied with an apparently normal roentgenogram.

The esophageal surgeon is more than a clever operator; he must know the clinical as well as the surgical aspects, be conversant with endoscopic procedures and able to cooperate with physicians, anesthesiologists, radiologists and pathologists. He is not a specialist in all of these branches of knowledge, but he does know the problems the esophagus poses to each. The physician is also unfit to decide whether to send his patients for operation. Close collaboration is the best policy.

**Baila, A. E.: Fibrosarcoma of Mediastinum,** Soc. de Cir. de Buenos Aires, Bol. y Trab. 37:638, 1953.

This is a brief paper presenting roentgenograms and specimens removed from a patient, which the author considers interesting as a contribution to the literature on tumors of the mediastinum. A case is reported, with operation, postoperative course and pathologic observations summarized.

**Lacour, G. A.: Anterior Mediatinotomy: Surgical Technique,** Cln. Tórax. Bs. A. 5:127, 1953.

The author reviews the anatomic picture of the sternal region and mediastinum and lists briefly the several technics that give access to pathologic conditions of the anterior portion of the mediastinum, with total or partial section of the sternum. Milton's total longitudinal sternotomy, a technic that has been found useful for the conditions mentioned (thymic tumors, aneurysm of the ascending portion of the aorta, etc.) is described in detail as modified by the author. For constrictive pericarditis, the advantages of ample pericardiectomy, especially over the right cavities of the heart and the point of entrance of the venae cavae in the pericardium are emphasized. E. Holman's technic, which gives an excellent field for operation, is described.

Case histories and roentgenograms of patients operated on at the Institute of Chest Surgery, directed by Professor Jorge Taiana, are given. The results were satisfactory.

**Halperin, A.: Pierini, D. O.; Mórtola, G., and Acrich, M.: Sero-Fibrinous Pleurisy: Apparent Onset of General Hystoplasmosis,** Prensa méd. argent. 41:575, 1954.

The author reports a case of hystoplasmosis, which was peculiar in that its clinical onset took the form of serofibrinous pleurisy, resisting the usual management, which led to decortication. Lesions of the skin and oral mucosa coexisted. The diagnosis was made by detection of Hystoplasma capsulatum in microscopic slides of the skin, the gum mucosa and the pleura, confirmed by culture. In the short time since the patient was first seen, sulfa drugs have considerably improved both the lesions and the patient's general health.

**Taiana, J. A.: Method for Chest Patients, Clin. Tórax, Bs. A. 5:73, 1953.**

This paper is a lesson given at the official course in Chest Surgery. The author points out the advantages of following a certain routine for patients with thoracic disease, including physical examination, roentgen examination and endoscopic study. The lesson is illustrated by a discussion of several cases presented.

**Schiepatti, E., and Villegas, A. H.: Bronchial Adenoma, Clin. Tórax Bs. A. 5:86, 1953.**

The authors present a short paper on the case of a woman patient. All observations from divers examinations and tests are included, and a brief description is given of the operation performed.

**Taiana, J. A.; Schiepatti, E., and Villegas, A. H.: Bilateral Bronchiectases: Medical and Surgical Treatment in 52 Cases, Clin. Tórax Bs. A. 5:5, 1953.**

The authors emphasize the need of long and careful preparation for operation on patients with bilateral bronchiectases.

They prefer the "face down" decubitus position on the operating table and the policy of operating on the more seriously affected side first.

Thirty-three patients were operated on, 5 bilaterally and 28 on one side only. The only 2 deaths occurred in the first group. The death rate in the bilaterally treated group was 40 per cent; the total death rate was 6 per cent and the operative death rate, 5.4 per cent in the 37 operations performed. Of the 33 patients, 19 were cured, 12 improved and 2 died.

**Villegas, A. H.: Method for Bilateral Bronchiectasic Patients, Clin. Tórax Bs. A. 5:153, 1953.**

The author describes the method employed in the study of 32 cases treated at the Institute of Chest Surgery, in Buenos Aires. He emphasizes the importance of giving these patients a thorough routine check-up before operation, and discusses the advantages of the system used at the Institute.

**Villegas, A. H.: The Development of Surgery of Bilateral Bronchiectasis in Argentina, Clin. Tórax Bs. A. 5:69, 1953.**

This is a chapter from the author's doctoral thesis, "Bilateral Bronchiectases," in which he reviews the Argentine literature on the subject. He notes that several surgeons have paid particular attention to radical operation on the lung as treatment for the condition. The first reports date from 1936, when excision was performed on one side alone, as the condition was unilateral. In his reference to the literature on the subject, the author states that he has found very few Argentine workers who have dedicated especial attention to the problem of bilateral bronchiectasis.

**Villegas, A. H.: Bilateral Bronchiectases, Clin. Tórax Bs. A. 5:153, 1953.**

The author presents a case observed by him, with all the observations therein. Four roentgenograms are included. The operation performed is described in detail.

**Palacio, J.; Tourreilles, J. F.; Hofman, D., and Morelli, O. H.: Alveolar Carcinoma of Lung: Clinical and Pathological Study, Prensa méd. argent. 41:511, 1954.**

A clinical and pathologic study of a case of alveolar cell carcinoma of the lung in a woman aged 45 is presented. The tumor developed without fever, with the picture of hemorrhagic pleurisy on the left side and a micronodular image in the right lung. Severe dyspnea and coughing was observed. Physical and roentgen examination ruled out tuberculosis, metastatic tumor and endothelioma of the pleura. By exclusion, the diagnosis of alveolar cell carcinoma of the lung or adenomatosis of the lung was made. Microscopic study confirmed the former.

According to the observations of others—and the authors of this paper agree—the main characteristics of the condition are as follows: 1. It is an unusual form of pulmonary cancer. 2. The duration of the disease is usually long. 3. Physically and roentgenographically the growth differs from canalicular cancer. 4. From the onset, the lesions extend to both lungs and are multicentric. 5. There is abundant mucous expectoration similar to that associated with allergic conditions of the respiratory system or some viruses, which may bring about electrolytic depletion. 6. Very severe dyspnea and asphyxial death may occur if operation is not performed in time. 7. There is no Bamberger-Marie syndrome. 8. The [illegible] apparently more frequent in [illegible] 9. T[illegible] roentgen picture might be confused with that of hematogenous tubercular dissemination, or the nodular form of neoplastic metastasis, or with chronic pneumonia in the diffuse form. 10. There is little or no glandular reaction; metastases are rare; the pleura and bronchi are seldom invaded. 11. Diagnosis is sometimes certified by the cytologic content of the sputum and bronchial secretion.

Several of these features are also associated adenomatosis of the lung, differentiation from which may be difficult even with the aid of the pathologist.

**Yódice, A., and Le Chiare, F.: Cancer of Lung,** Semana méd. 104:7, 1954.

On the basis of a study of 111 file cards on lung cancer, followed since 1946 to the present, the authors reach the following conclusions:

1. The authorities must organize a campaign of public education, for both sexes, but mainly for males, on the dangers of using tobacco in excess.

2. Routine half-yearly medical and roentgen check-ups of the population are advised.

3. Teams should be organized in the main hospitals, composed of physicians, pathologists, radiologists, endoscopists and surgeons specializing in thoracic disease.

4. A public educational campaign should be undertaken to point out the danger of the disease and the significance of certain symptoms, particularly cough and hemoptysis in persons over 40.

5. The public should be reminded persistently by means of the radio, the cinema, posters on walls, etc., that if it is caught in time the disease can be cured for good by surgical means.

**Basabe, H., and Blando, H. R.: Precociously Cavitating Lung Cancer,** Semana méd. 104:36, 1954.

The case of a patient is reported whose state of health, sex, main symptoms (pain, fever, mucopurulent expectoration and abundant hemorrhage), laboratory tests and roentgenograms showed that he had a precociously cavitating form of adenocarcinoma of the lung.

The authors state that carcinoma of lung may produce ring-shaped cavity images, usually in the parahilar zone, communicating with the mediastinum.

**Cesanelli, A.: Treatment of Lung Cancer,** An. de Cir. (Rosario) 18:10, 1953.

This paper celebrates the tenth anniversary of the date when Graham performed the first successful pneumonectomy for cancer, with which achievement a long chain of attempts at surgical treatment of the condition culminated, the author has studied the means of treatment of pulmonary cancer in detail.

After brief general comments and a short résumé of medical treatment, which includes irradiation and the use of nitrogenated mustard gas, the author turns his attention to surgical treatment. He reviews the surgical literature, the obstacles to the initiation of surgical treatment and preoperative diagnosis, technic, surgical progress, preoperative and postoperative care, the operative mortality rate (27 per cent in his statistics) and the end results.

The paper is based on statistics drawn from 54 resections performed by the author, tabulated as follows:

| | |
|---|---|
| Deaths at operation | 16 |
| Deaths later | 22 |
| Survivals | 16 |
| Duration of survival of the 22 who died | |
| 2½-3 years | 3 |
| 2-2½ years | 1 |
| 1-1½ years | 4 |
| 6 months-1 year | 7 |
| 3-6 months | 7 |
| Duration of survival of the 16 alive | |
| Over 5 years | 3 |
| 2-3 years | 3 |
| 1-2 years | 5 |
| Under 1 year | 4 |

**Gómez Garcia, R. E.; Malajovich, G.; Garcia Espil, E., and Eguia, B.: Medical and Surgical Discussion of 64 Lung Cancers,** Clin. Tórax Bs. A. 5:146, 1953.

The authors are not unconditionally enthusiastic supporters of ample resection for advanced cancer of the lung. On the other hand they consider that dissection and stripping of connective tissue and lumph glands from the mediastinum and tributary zones is warranted in the presence of circumscribed cancer.

It is their impression that such procedures can be justified only as cleaning operations and as a complement to cancer treatment, and that they are hardly justifiable from a humane point of view. In fact, for the treatment of advanced pulmonary cancer, they are rarely better than the usual anodyne medication. It would be much better to employ the same resources as a means of detecting symptomatic cases.

**Bupo, J. A.: Reexpansion of Upper Lobe in Inferior Lobectomies, Clin. Tórax Bs. A. 5:16, 1953.**

An anatomic and topographic study of the pedicles of both upper pulmonary lobes is made. The factors that intervene in incomplete reexpansion of the upper lobe in in*ferior lobectomy are analyzed as to both the* preoperative and the postoperative period.

Treatment of collapse of the upper lobe, according to circumstances and in the light of experience obtained at the Institute of Chest Surgery, is discussed.

***Taiana, J. A., and Aracama Zorraquin, V.:* Resection of Lung for Large Tubercular Cavities, Clin. Tórax 5:108, 1953.**

The history of this form of treatment is outlined. Indications, contraindications, tactics and technic are analyzed.

The authors' experience comprises 19 cases, in all of which operations were performed, with dissection and ligation of the separate elements of the pedicle. Complica*tions and failures are more frequent in pa*tients who have undergone operations on the chest before (thoracoplasties, cavernostomies, etc.) and in patients over 40.

Four patients died, 1 in the first month and 1 in the first year after the operation. Fifteen survived more than a year and were apparently cured at the time of writing (78.4 per cent). The longest period of survival was more than four years.

**Belleville, G. I.: Surgical Treatment of Lung Tuberculosis, Bol. y Trab. de la Soc. Argent. de Cirujanos 21:752, 1953.**

This is a long paper reviewing the possibilities of surgical therapy for pulmonary tuberculosis at present. It would be a mistake, however, to assume that the author considers the treatment of tuberculosis surgical. The main treatment must remain in the hands of the phthysiologist, as the condition is a general one with local foci; the surgeon is called in to treat some focus and consolidate the cure, or to treat a complication.

With tuberculosis, perhaps more than with any other morbid condition, it is impossible to have preconceived ideas and standard technics or tactics. Success is the outcome of opportune treatment rather than of the manner in which it is carried out, and it must be neither capricious nor routine; it must arise as a natural response to the needs of the condition and the potentialities of the patient.

**Schneier, M.: Monaldi's Intracavity Aspiration: Present State; General Remarks, Arch. Argent. de Tisiol. 29:156, 1953.**

The author reviews the current indications for this procedure on the basis of pathogenesis and the development of cavities. He outlines the divers hypotheses that are favored as explanations of the distention of caverns and the failure of different surgical procedures. He discusses the usefulness of cavity aspiration alone and combined with other measures, and the convenience of substituting lung resection for it when indicated.

The method, like any other, is useful when precisely indicated and performed according to all the rules of faultless technic. The advantages become rapidly apparent when bacillary intoxication is the main factor. Cough and expectoration diminish, and on occasion the cavity closes without any other treatment. At other times collapse therapy becomes *necessary. The benefits are mani*fested locally and in the patient's general health. It is not advisable for residual postthoracoplasty caverns, for which the technic is difficult and results uncertain. For distended avalvular caverns on the draining bronchus, for giant caverns and in destruction of lung tissue, resection is to be preferred.

**Aguilar, H., and Schneider, M.: Indication of Extrapleural Pneumothorax; Bases, Arch. Argent. de Tisiol. 29:141, 1953.**

The authors base their study on the physiopathologic changes in the collapsed l[illegible] paying particular attention to the [illegible] beneficial effect on the injured lung and the elimination of contamination of the patient's economic and social life. The authors analyze succintly the advantages and drawbacks of this means of treatment, noting that complicating hemorrhage and infection are infrequent if double tubes are left in the wound for drainage.

**Taiana, J. A.: Cardiovascular Surgery,** Clin. Torax Bs. A. 5:39, 1953.

This paper is a lecture delivered during the Chest Surgery course, referring to the surgical treatment of certain congenital anomalies independent of trauma.

The author groups this study of the subject under three headings: congenital conditions that benefit from surgical treatment; those which may benefit, and those in the experimental stage.

He discusses ductus arteriosus and coarctation of the aorta in detail.

**Martiarena, L. H.: Fallot's Disease,** Soc. de Cir. de Buenos Aires Bol. y. Trab. 37:594, 1953.

The author presents 2 cases in which cardiac catheterization was used for the study of Fallot's disease: in earlier cases angeiocardiographic study was used. In the author's opinion the ideal method is a combination of the two.

**Kreutzer, R.: Fallot's Tetralogy and Corvisart—Caillot's Disease,** Orientación Méd. 71:464 (Jan. 8) 1954.

This condition was first described by Sandifort a century ago; it is known nowadays as Fallot's tetralogy. The types of pulmonary stenosis observed in anatomic specimens from patients with Fallot's tetralogy are described on the basis of 20 autopsies, in which pulmonary valvular stenosis was observed only once. The pathologic picture, clinical signs, symptoms, complications, roentgen picture, auscultation, electrocardiogram, angiocardiogram, etc., are discussed.

Finally the author analyzes the anatomic requisites for Taussig-Blalock's operation and discusses treatment that must be given once the operation has been decided on. The operation lasts two to two and one-half hours. Suture takes fifteen to twenty minutes. In general, in the author's cases, the operation was very successful, which encourages him to treat such patients surgically, not to obtain cure but to assure them of normal lives.

**Cossio, P.; Burucúa, J. E.; Perosio, A. M., and Pecorini, V.: Pressure Values in the Left Auricle Before and After Mitral Commissurotomy,** Prensa méd. argent. 41:35, 1954.

An easily applied manometric system proposed by the authors was used. Pressures were invariably high, and in spite of the drop after a successful operation the values remained above normal. The manometric method is proposed as a test of success of the operation and as a guide for the surgeon.

**Joselevich, M.; Sucari, L., and Mactas, B. A.: Diagnosis of Tumors of the Heart,** Prensa méd. argent. 40:3530, 1953.

Heart tumors, both primary and secondary, are still discovered at necropsy, despite the rules laid down by some authors for their diagnosis during life. Many of the clinical, roentgen and electrocardiographic signs on which diagnosis is claimed to be founded lack specific value and may be present in other and more frequent conditions. Those alone which, for the authors, have any value are as follows: for primary tumor, the clinical signs of valvular defect that varies in different positions (valvular polypoid tumors) and tumor shadows in ordinary plates and angeiocardiograms; for secondary tumor, the presence of heart block (especially if the liquid is hemorrhagic) and electrocardiographic abnormalities evidencing an undoubted myocardial lesion that has developed in a short time.

Diagnosis will be easier if the symptoms caused by these tumors are known and if, in a particular case, one thinks of the possibility of their existence. Thus, it is easier to detect a secondary tumor if the primary one has been first discovered. Even in these circumstances, however, only if one obtains material that permits identification of tumor cells (pericardial puncture) can one diagnose the condition with certainty. The authors' experience is punctuated with mistakes in interpretation: metastases in the heart which were not discovered until autopsy was performed, and signs mistakenly attributed to spread of the tumor to the heart. Such is the case with several patients mentioned in earlier papers and 1 whose case is reported in this paper, in whom clinically a metastasis of a bronchopulmonary cancer was supposed to exist in the heart but at autopsy was conspicuous for its absence!

**Tricerri, F. E.; Donato, F. O.; González Varel, A.; Rocca, J.; Pisanu, A., and Di Salvo, V.: Surgical Treatment of Mitral Stenosis: Concerning 100 Cases Operated On, Prensa** méd. argent. 41:477, 1954.

The treatment of mitral stenosis is no longer experimental and offers the patient a definitive solution in which the risk is slight. In the authors' opinion, all patients with mitral stenosis producing functional symptoms should have surgical treatment. The seriousness of the condition is borne out by statistical studies and by the fact that 4 patients within the authors' experience died of accidents peculiar to the disease during the preoperative phase.

At times, as Taquini has pointed out, the operation may assume urgency, particularly for patients who have the picture of "cor pulmonale" combined with mitral stenosis. Risk at operation depends on the individual patient's condition, for the older the heart failure the greater the patient's limitations; the larger his heart, the greater the risks which must be faced during operation and the smaller the benefits which operation may be expected to produce.

In the authors' experience the mortality rate for Group IV coincides with that given by Taquini, and no deaths occurred in Groups II and III. Only 2 patients died as a result of operation, out of the last 60 who were operated on. The authors are convinced that early recognition of the indications for this operation will reduce the present total mortality to below 5 per cent.

**Del Valle, D.: Constrictive Pericarditis. Pericardiectomy by Intercostal Thoracotomy; Cure,** Acad. Argent. de Cir. Bol. y Trab. 37:525, 1953.

A woman patient is described, with a complete clinical study and a diagnosis of constrictive pericarditis, which was perfectly corroborated at operation. The classic picture of hyposystolia, malleolar edema, gross ascites, enlarged liver, cyanosis, weak heart sounds, a small pulse, tachycardia and venous hypertension was present. The clinical course lasted six months, beginning with corticopleuritis with liquid in the pleura on the left side. The operation is briefly described.

The patient improved after a week and was going on favorably three months after the operation. She was in excellent health and had no breathlessness on walking. The remaining symptoms had disappeared or diminished, except venous hypertension due to incomplete disappearance of disystolia.

The thoractomy performed made it possible to liberate completely both ventricles, the main agents in the reestablishment of the circulation, and to cure the patient. The successes obtained with this technic and tactics now amount to over 12 cases.

In addition, preservation of the chondrocostal arches permitted reconstruction of the thorax without leaving any anatomic traces or functional deficit.

## SURGERY OF TRAUMA

**Didier, A.: Spontaneous Rupture of the Extensor Tendon of the Third Finger,** An. de Cir. (Rosario)18:85, 1953.

The author first reviews the papers published by divers others on the rupture of the extensor tendons of the fingers. He has had occasion to treat a patient with rupture of the tendon of the third finger who had suffered, four years earlier, a fracture of the distal end of the radius. According to the literature this is the third known case of rupture of one of the tendons of the common *digital extensor after trauma to the wrist,* which warrants its publication.

The author presents the patient's case history, with roentgenograms and photographs, and describes the operation performed. He discusses the case and states that the treatment applied, which was suture of the distal tendon stump to the second finger, is the simplest and the one that offers the best chance of success. Transplantation of the tendon is only exceptionally indicated.

He considers it useful to leave the posterior carpal ligament without suturing, as *this eliminates friction. Friction* is a factor in the production of tenosynovitis, as it leaves the extensor tendons freedom of movement and facilitates the regression of changes which may already have begun in some of them. It did not become necessary to perform osteotomy on the radius, which would have been in order had the patient's complaint not been relieved.

**Roca, C. A., and Romas Vértiz, J. R.: Traumatic Rupture of the Biceps Brachii,** Prensa méd. argent. 41:582, 1954.

On the basis of 12 cases observed by the authors, they review the main characteristics of the lesion and bring its treatment up to date.

**Carnevale, V.: So-Called Footballer's Traumatic Inguinocruralgia,** Prensa méd. argent. 41:355, 1954.

The author discusses an apparently trivial condition without immediate osseous lesions, but one that brings lasting pain and incapacity (four months or more), exhibited by patients of his. He later noticed it mentioned in certain Italian medical publications, motivating interesting papers whose authors agree in many respects. The condition was severally named "rectus and adductor syndrome in footballers," "footballer's anterior periarthrosic syndrome" and "footballer's traumatic inguinocruralgia." The last is preferred by the author, because though it may not be the best, it does indicate the original location and the main symptoms of the condition. All the patients played either soccer or rugby except a sedentary worker who had taken part in a competition and a worker who had had an accident.

The manner in which the lesion is produced, as well as the symptoms, diagnosis and treatment, are discussed. The author has tried several forms of management and finds that, whether the lesion predominates in the rectus, the adductors or the symphisis pubis, it is best to keep to the following plan: After a few days of absolute bed rest, with or without sedatives, a bilateral plaster cast is applied from the costal edge to the femoral condyles, with the thighs in slight abduction. This is worn for two months, with bed rest for the first thirty days. The cast is gradually removed, and physiotherapy (Bier's oven) and reeducation are applied. It is usually another month before sports can be practiced. Ultrasonic waves obtain quicker reduction and disappearance of the suffusions and reduce the extent of the painful area as well as the intensity of the pain, but the condition lasts just as long as with any other treatment.

The author points out the curious fact that in all the cases known the limb affected was invariably the right.

## UROLOGIC SURGERY

**Pataro, V., and Carreño, O. C.: Horseshoe Kidney: Symphisotomy,** Prensa méd. argent. 41:54, 1954.

A case is reported in which symptoms were extremely marked, surgical tactics interesting and the patient's improvement spectacular. The pathogenesis and scanty symptoms of the anomaly are reviewed; the case history of the patient (a woman) is given, and the operation is described. The postoperative course was uneventful, and the patient left the hospital after six days. Four months later the patient continued well and was free from all the symptoms that had been troubling her for ten years. Roentgenograms showed that the kidneys had straightened and the dilatations of the excretory passages had disappeared. At the time of writing the cure persisted.

**Salaber, J. A., and Guixá, H. L.: Urinary Incontinence from Urogenital Communication,** Prensa méd. argent. 41:247, 1954.

The authors report their experience with 83 urogenital fistulas among 11,607 gynecologic patients (7:1,000). They analyze from the literature the data they consider important. The paper touches on the following points: definition and classification (ureterogenital, vesicogenital, urethrogenital, combined and complex or mixed); etiopathogenesis (gynecologic, surgical obstetric, or tokogenetic, spontaneous, operative actinogenetic, actinosurgical, carcinomatous, traumatic and inflammatory) and pathology. Each point is considered in detail with regard to etiologic factors and pathogenesis, pathologic picture, symptoms, diagnosis, prognosis, prophylaxis and treatment; and certain other aspects of the subject are discussed. Finally, the authors analyze the cases of fistula originating in operations performed in the department of Gynecology of the Buenos Aires Medical School.

**Guixá, H. L., and Otturi, J. E.: Etiopathogenic Study of Vesicovaginal Fistulas,** Semana méd. 104:27, 1954.

The study is based on an analysis of the cases treated at the Chair of Gynecology of the Buenos Aires Medical School from 1928 through 1953. Among some 19,000 patients, 58 vesicovaginal fistulas were observed, 22 of which were tokogenetic, (37.93%), 16 surgical (27.58%), 16 carcinomatous (27.58%) and 4 actinogenetic (6.89%). Thirteen of the tokogenetic group were due to tears and appeared immediately, and 6 were due to necrosis; in 3 the detail was not ascertained. Nine of the surgical group appeared after total or amplified total hysterectomy; 4 after corrective operations for genital prolapse; 1 after an operation for rectovaginal fistula by the vaginal route, and 1 after vulvectomy and excision of the urethra for vulvo-urethral carcinoma. Eight resulted from the wound (immediate fistulas) and 8 were due to trophic tissue changes (late fistulas). Neoplastic fistulas were always the result of an advanced stage in the growth of a carcinoma of the cervix uteri; 3 of the patients complained of incontinence of urine. Actinogenetic fistulas appeared after roentgen therapy for carcinoma of the cervix uteri.

**Rosemblit, E.: Ectopic Testicle and Cryptorchidism,** Semana méd. 103:896, 1953.

When a patient has one or both testicles out of the scrotum, differential diagnosis must be made between halted descent within the abdominoinguinoscrotal duct (cryptorchidism) and situation outside the duct (ectopy). Once the diagnosis has been made of ectopy or fixation by anatomic anomaly, from which descent is not to be expected even if hormone therapy is used, operation is in order to fix the testicle in the scrotum when the patient is 6 years old. Hormone treatment should not be instituted for cryptorchidism before the patient is 10 or 11; it should not be prolonged for more than six months, and if it fails operation should be resorted to without further delay. Changes in the germinative epithelium are precocious and have been shown to take place at the prepubertal age, intensifying from puberty on. Hormone therapy, therefore, should be continued after operation to obtain the maximum trophism. In cryptorchidic testicles that have descended after hormone therapy, this should not be stopped, but rather continued under clinical and spermatographic control.

**Arrendondo, H. F., and Albertengo, A. G.: Masculine Genital Elefantiasis: Surgical Treatment,** An. de Cir. (Rosario) 18:77, 1953. Bol. Soc. de Cir. de Rosario 80:165, 1953.

One case is reported in which radical operation was successful both functionally and cosmetically.

A case is reported in which both functional success and esthetic success were obtained.

## VASCULAR SURGERY

**Iusem, M.: Ascending Phlebography with Patient Erect,** Prensa méd. argent. 41:587, 1954.

In a first section of this paper the author mentions the growth of phlebographic technic in the past fifteen years and its real usefulness in daily practice; he brings the subject up to date. He reviews the conditions that require phlebographic study of deep veins, observing that eczema, edema, pigmentation and ulcer are not peculiar to any one particular venous condition, and phlebographic study alone can solve the problem. In the second chapter he refers to technic, ascending, decending and retrograde. He describes briefly the methods used by divers workers and their several technical modifications. The horizontal decubitus position, was the rule for ascending phlebographic examination until Scott and Roach suggested the erect position in 1951; the value of this position has been confirmed by later work, which persuaded the author to use it for his patients. Its advantages are: (1) a simple technic available to the general practitioner, wherever he works, as a routine test; (2) complete filling of deep veins, permitting a thorough anatomic study, and (3) the fact that it is the physiologic maximum hydrostatic pressure position which makes it possible to observe the behavior of failing valves and communicating veins, giving the method the value of a functional test. The technic is described in detail. In the third and last section the author analyzes medical and roentgen interpretation in cases of various diseases of the veins, closing with the statement that, in his opinion, the points discussed in his paper should interest both physicians and surgeons with regard to study of the venous circulation in the lower limbs. Much can be learned from this simple and harmless means of examination, which produces maximum information with minimum discomfort to the patient.

**Collados Storni, M. P.; Ruggeri, F.; Lavise, J., and Vittoni, E. M.: Carotid Angiography with Controlled Arterial Hypotension for the Study of Brain Circulation: Preliminary Report,** Prensa méd. argent. 41:115, 1951.

The authors consider that carotid a[illegible] graphic procedures, [illegible] the of ganglioplegics, are [illegible] ence of the following conditions:

1. Cerebral angioma, when it is indispensable to locate and ligate the tumor's afferent blood vessels, as a first stage, leaving the emptying vessels to be tied at the end of the procedure. Otherwise, if the opposite is done, the tumor is filled under pressure and may burst.
2. Aneurysms, especially when the sac is large and the neck is small, so that under normal conditions of circulation, filling does not occur.
3. Cartoid-cavernous fistulas.
4. Highly vascular tumors (meningioma, glioblastoma).

Satisfactory brain angiograms can undoubtedly be obtained without recourse to gangliographic procedures in any patient who has no cerebral edema or accelerated circulation. If the team's work is well coordinated, good plates will surely result, but they are firmly convinced that the method they suggest is useful for cases with marked edema of brain and accelerated circulation.

**Lienhard, C. P.: Phlebothrombosis and Thrombophlebitis,** Soc. de Cir. de Buenos Aires Bol. y Trab. 37:661, 1953.

The article is a paper read by Dr. Alfredo Ferreira. The author states that he does not mean to make an exhaustive study of the subject, but rather simply to discuss 31 cases of phlebothrombosis and thrombophlebitis of the limbs.

The reader adds his comments to the author's discussion of the subject.

**Feldman, L.: Ilio-aortic Thrombosis: Leriche Syndrome,** Semana méd. 103:809, 1953.

The author transcribes an address made at the Sociedad Argentina de Cirugia as a commentary on a report by Dr. Puyó Villafañe, read by Dr. Introzzi, and explanatory remarks made by Dr. Goñi Moreno.

It is important to have clear ideas about high arterial obliteration, as knowledge of the condition leads to a different interpretation from that usually given to vascular disturbance in the limbs and complicating gangrene, whether due to endarteritis or diabetes. Long experience has taught him that conservative treatment is completely successful if duly warranted, i.e. in the benign clinical forms of the disease, but fails invariably with malignant forms, just as do all the surgical procedures and their combinations.

**Puyó Villafañe, E.: Ilio-aortic Thrombosis: Leriche Syndrome,** Acad. argent. de Cir. Bol. y Trab. 37:544, 1953.

The author summarizes a monograph read before the Academy, reporting the results obtained in 6 cases of ilio-aortic thrombosis treated by resection of the artery and sympathectomy combined. A succint discussion of the subject follows.

**Gurruchaga, J. V.: Aneurysm of Abdominal Aorta,** Bol. Soc. de Cir. de Rosario 20:114, 1953; An. de Cir. (Rosario) 18:42, 1953.

Having operated on a patient with an aneurysm of abdominal portion of the aorta due to arteriosclerosis, the author discusses several physiopathologic aspects and the symptoms of the condition, both physical and roentgenographic. He also outlines the divers technics that have been suggested for its surgical treatment. In the course of an abdominal operation it is occasionally necessary to face the fact of the presence of an aneurysm of the infradiaphragmatic segment of the aorta; diagnostic doubt arises in differentiation of the growth from other tumors of the same region, and the possible treatment is not always within the capacity of the attending surgeon.

The patient's case is described, and the operation, which consisted of inactivation of the aneurysm by intrasaccular wiring, is explained.

**Fasce, A. L.: Intermittent Obstruction of Subclavian Vein,** Bol. Soc. de Cir. de Rosario 20:133, 1953.

The upper limb is frequently the site of morbid conditions, among which is obstruction of the subclavian vein. The author reports the case of 1 patient treated by him, since the condition is little known in Argentina.

The clinical picture is not very clear cut; neither is the etiologic background simple, and authors disagree on the subject, so that it has been given several names: "intermittent venous claudication," "traumatic venospasm," "effort thrombosis," "Paget-Schroetter's effort." Some degree of trauma is always present (usually overabduction) or some unaccustomed effort. The syndrome is sudden in onset. The patient's attention is caught by the bluish tinge of the skin, the swelling and especially the feeling of heaviness in the affected limb. Paresthesia is not invariably present. It is usual to see a network of bluish veins at the root of the limb. The condition appears in subjects who enjoy perfect health, usually young and male, and in 66 per cent of cases it occurs in the right arm. Venospasm secondary to the constriction is considered the cause of the syndrome, and there is constantly observed an increase in venous pressure.

The author discusses symptoms, diagnosis and pathologic manifestations briefly. The treatment of choice is operation for control after attempting sympathetic block and rest with the arm raised.

The patient's case history is given, and the paper closes with the author's comments.

**Carrillo, R.; Matera, R. F.; Dulacska, J., and Driollet Laspiur, R.: Leriche Syndrome: Importance of Aortography and New Surgical Departures,** Arch. de Neurocirugia 9:169, 1952.

Leriche's syndrome, or chronic thrombosis of the ilio-aortic sector, is a type of parietal arteritis which begins at the age of 30, with its origin far up on the primitive iliac arteries. It appears as a progressive condition that first follows the direction of blood flow, then passes the aortic fork and reaches the iliac artery on the other side, turning the aorta into a veritable cul de sac and, by causing stagnation of blood, brings about lesions of the arterial parietal endothelium. The clinical symptoms are (1) an imperceptible femoral or iliac pulse; (2) absence of oscillations; (3) fatigue on standing up but not on walking and (4) functional impotence followed by organic impotence. The disease progresses; when the progress is upward, it may obstruct the renal arteries and cause grave uremia. In other cases thrombosis of the leg arteries is followed by thrombosis of the large veins in the thigh, causing violent pain and gangrene on one or both sides; the patient's future is confinement to his bed for a long time and until his death.

Aortographic investigation entails no risk and should be practiced in every case in which the syndrome is suspected. Patients in the first phase of the condition may be cured definitively by proper surgical treatment.

**Berenstein, P.: Leriche Syndrome; Chronic Aortoiliac Thrombosis; X-ray Contribution,** Prensa méd. argent. 41:840, 1954.

The author describes Leriche's syndrome, reviewing the pathogenesis and the pathologic picture. The technic of aortography and interpretation of the plates is explained. The only contraindications are sensitivity to iodine salts, severe liver or kidney failure (up to 2 gr. of urea does not contraindicate an aortographic procedure). If the patient's general health is satisfactory, neither age nor arteriosclerosis is a contraindication.

**Fasce, A. L.: Arterial Ulcer,** Bol. Soc. de Cir. de Rosario 20:78, 1953.

Ulcers located at the distal extremity of the lower limb are the most evident complication of disease of the peripheral blood vessels, and their etiologic diagnosis helps to elucidate an intricate problem.

The author reviews the literature on the subject, describing the pathologic nature of hypertensive supramalleolar ulcers, an unusual complication in patients with high blood pressure; its main clinical characteristic is pain that rest does not relieve, but walking does exacerbate.

The author discusses diagnosis and states that lumbar sympathectomy is the treatment of choice, the quickest and surest for curing the condition. He closes the paper with the history of 1 case observed by himself and says that the paper is published to make the condition more widely known.

**Foa, A.: Treatment of Angiomas in Childhood,** Prensa méd. argent. 41:595, 1954.

This is a report of the results obtained with curietherapy in 60 cases of angioma, mostly in children. This type of treatment was preferred for its simplicity and its freedom from risk and from tissue reaction. 100 per cent cures were obtained with very small doses in 100 per cent of cases.

## SURGICAL INSTRUMENTS AND APPARATUS

**Baistrocchi, J. D.: A New Phleboextractor,** Soc. de Cir. de Córdoba Bol. y Trab. 4-5-6-7: 147, 1953.

Having used all known models of phleboextractors, the author has added one of his own, without aspiring to be original, and has used it for treatment in some 1 [illegible] over more than a y [illegible]

The apparatu [illegible] e of

are described, the author pointing out that he does not consider that it should be used in all cases; it is an aid to treatment and may increase security in cases in which a varicose condition is due to removal of the internal or external saphenous vein alone. He does not agree with some very distinguished surgeons who hold that phleboextraction is a routine procedure that infallibly cures varicose veins. He considers retrograde sclerosing injections after ligation of all failing communicating veins (as shown clinically or by roentgenogram) the only "phleboextractor" that can always be used and that gives the patient definitive relief.

**Irribarren, R. R.: An Apparatus for Cutting Laminate Grafts,** Arch. Oftal. de Bs. A. 453, 1953.

The author describes an apparatus he has invented to eliminate the difficulty in obtaining a good corneal graft by cutting a laminate graft from the donor eye, since material which is scarce or hard to get at the right time is often wasted. Its use has given him satisfactory results.

**Libman, E.: A Simple Model of Trephine and Complement for Perforating Keratoplasty in Two Layers or Step-Shaped Keratoplasty: Made in Argentina,** Arch. Oftal. de Bs. A. 28:565, 1952.

Of all the existing models of keratoplasty trephines, the author describes one whose interest lies in that it can be made in Argentina. Its edge is all but perfect. The paper is illustrated with two diagrams of the instrument.

**Copello, A. J.: A New Surgical Needle,** Prensa méd. argent. 41:424, 1954.

The author describes an automatic surgical needle and includes several explanatory diagrams. Various surgeons have found it satisfactory, and it has been used in divers surgical services with satisfaction.

### CHEMOTHERAPY AND ANTIBIOTICS IN SURGERY

**Ottone, J. E.: Prevention of Accidents After Transfusion: Our Experience Over 10 Years,** Semana méd. 103:822, 1953.

There are post-transfusion reactions to blood transfusions, performed with every care, in 5 per cent of cases. The addition of calcium gluconate to the blood before transfusion does not appreciably modify this percentage. The addition of pyrazolone salts does reduce the incidence and intensity of the reactions. The addition of 1.5, 3 or 5 cc. of Coramine, proportionally, practically eliminates reactions after transfusion. On the basis of a series of 300 transfusions plus Coramine the author strongly recommends this method as innocuous, effective, simple and inexpensive.

**Ruiz, V., and Benzecry, I. I.: Infiltration of Antibiotics and Novocain in Inflammatory Conditions in Women,** Semana méd. 104:57, 1954.

After a brief sketch of the history of the use of anesthetic substances to combat the pain of pelvic inflammation in women, and its later association with antibiotics, the authors report on their satisfactory experience with parametrial infiltration of mixtures of procaine and penicillin, streptomycin or terramycin in 596 women with gynecologic conditions of that type, in many of whom no success had followed other forms of treatment.

**Mancini, R. E., and Hass, C.: Local Effect of Hyaluronidase in Para-articular Cystic Mucoidosis (Ganglion),** Semana méd. 103:837, 1953.

The histologic and cellular chemical aspects of 6 excised ganglion tumors were studied. In 3 more, before excision, 1 to 3 separate injections of hyaluronidase (testicular, 150 T.U. dissolved in 1 to 2 cc. of physiologic solution of sodium chloride) were given into the depth of the tissue. The enzyme was inactivated before its injection in 2 more cases. For histologic study of the connective tissue, hematoxylin-eosin and Azan's trichromic stain were used; Weigert's for elastic fibers; del Rio Hortega's for reticular and collagen fibers; metachromatic stain and Hale's colloid iron, controlled with hyaluronidase, for mucopolysaccharides; McManus-Hotchkiss', controlled with ptyaline, hyaluronidase and methanolchloroform for dextroproteins.

The authors observed: (1) that in ganglions without treatment there was mucoidosis of connective tissue, consisting of disappearance of collagen, reticulae and elastic fibers and involution of cells, and simultaneous new formation of amorphous substance composed of acid, hyaluronidase-sensitive mucopolysaccharides; (2) that in ganglions that had been treated with hyaluronidase, the volume was progressively diminished and the microscope showed disappearance of amorphous substance and dissolved connective fibers and *their replacement by cell and fiber growth* (fibroplasia), and (3) that the histologic and histochemical basis of the formation process of ganglions and the effects obtained by the use of hyaluronidase in their local treatment support the proposed name "cystic mucoidosis."

**Canónico, A. N.: The Use of Nitrogenated Mustard Gas in the Treatment of Advanced Cancer: Experience at the Angel H. Roffo Institute for Experimental Medicine, Acad. argent. de Cir. Bol. y Trab. 37:517, 1953.**

*The author concludes from his experience* (1) that nitrogenated mustard gas has an undoubted effect on the structure of malignant tumors, as regards the vitality of their cells, that is microscopically similar to that of irradiation; (2) that in significant numbers of patients temporary disappearance of some signs and symptoms occurs; (3) that at present this drug should only be used for *patients who are beyond aid from the usual* forms of treatment, and (4) that this and other evidence reported in the current literature encourages further work on chemotherapy for malignant disease, both in treatment and in biologic study of cancerous tissue.

**Viacava, E. P.; Schavelzon, J., and Mayo, J.: Intra-arterial Mustard Gas, Acad. argent. de Cir. Bol. y Trab. 37:564, 1953.**

The question is brought up to date by review of recent literature and the authors' slight experience. Publication is warranted by the interest aroused of late by several drugs that are used by the intra-arterial route. The authors review the subject and note that their experience leads to the conviction that mustard gas has an undoubted *action on tumors, particularly those located* in the pelvis, and they draw the following *conclusions:*

1. From a practical point of view, it is remarkable how soon pain, straining and tenesmus, which are so frequent in the advanced stages of pelvic tumors, disappear totally or partially.

2. In many cases reduction in size and *mobility of the tumor may be obtained.*

3. The problem of toxicity demands caution as to the indications for use of the drug and the manner of its use.

4. *Histologic changes that proved partial* or total destruction of the tumor growth were observed in every patient in the authors' series.

5. Up to the time of writing, benefits have always been temporary and, in most cases, short-lived. Only 1 patient has been followed for four months. She has not had to resort to sedatives since the treatment was begun; her general health is good, and the tumor appears to be stationary.

**Albertelli, J.; Mónaco, H.; O'Connor, T., and Bur, G. E.: Nitrogenated Mustard Gas in Serous Cavities in the Treatment of Propagated Malignancy, Prensa méd. argent. 41:201, 1954.**

*It is possible to use nitrogenated mustard* gas in the peritoneum or pleura of the human being for growths that have spread to those cavities. When these routes are used, general toxic phenomena are minimal. One of the most constant and remarkable effects is the rapid disappearance of fluid from the cavity. Consequently, there is improvement in general health, and the patient is relieved of *many of the causes of his discomfort. Another* consequence is the greater ease with which it becomes possible to obtain favorable results with other forms of treatment, such as irradiation.

Although there are unquestionable histologic changes in the tumor growth itself, *there is no noticeable effect on its volume* and further development. The changes observed are superficial; they do not penetrate the tumor mass.

The authors consider themselves justified in advising with enthusiasm that the drug be used as a palliative for malignant tumor that has spread to the serous cavities.

**Villamil, M. F., and Beheran, H. R.: Treatment of Phlebothrombosis with Intra-arterial Trypsine, Prensa méd. argent. 41:526, 1954.**

In 1 case of acute phlebothrombosis, intra-arterial injections of trypsine were followed by disappearance of all the symptoms in a little over twenty-four hours;— a post-
phlebitic syndrome that had go
seven years t *ame treatme*
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pain, remarkable attenuation of the edema and cure of an ulceration. Theoretically, the use of intra-arterial trypsine ought to be the most rational treatment for phlebothrombosis, as it aims at digestion of the clot, which is at the bottom of the whole condition *in situ*. Practice would seem to confirm this reasoning. Results have been obtained by using intra-arterial trypsine systematically in all cases of new or long-standing phlebothrombosis and its sequelae, which, in the case reported by the authors, were reduced to a minimum.

**Castillo Odena, I.: Pott's Disease: Radical Surgery and Marsilid,** Acad. argent. de Cir. Bol. y Trab. 37:553, 1953.

In a short paper the author presents a case history and an account of the operation performed. Later the patient was treated with Marsilid, an isopropylic derivative of isonicotinic acid hydrazid, a toxic drug that must be handled with care and is not yet on the market. The results were satisfactory, but not enough time has gone by to enable the author to draw conclusions. The encouraging result of combining the drug with surgical therapy induce the author to report them, as they open up possibilities in the treatment of bone and joint tuberculosis which have thus far not been suspected.

## MISCELLANEOUS

**Pescuma, D.: Present State of the Treatment of Cancer by Irradiation,** Semana méd. 104:274, 1954.

This report, presented to the Public Health Minister, encloses letters on the subject from divers authorities. The author closes with a note on the betatron as an instrument of treatment and experiment in biology.

**Sammartino, E. S.: Why There Ought to be Voluntary Blood Donors' Associations in Every Important City and Town in My Country and in Every Country in the World: Important Advice for their Better Foundation and Organization,** Semana méd. 104:38, 1954.

This article is the first part of an extensive and meticulous study of the subject, summarized as follows:

A. Introduction and motives for publication.

B. Reasons for such foundations.

C. Bases and grounds for better creation and organization of the associations.

D. Closing remarks.

E. Author's bibliography.

In the first part only the first points in the summary are dealt with.

**Sammartino, E. S.: Why There Ought to be Voluntary Blood Donors' Associations in Every Important City and Town in My Country and in Every Country in the World. Important Advice for Their Better Foundation and Organization,** Semana méd. 104:75, 1954.

Conclusion of a paper previously begun (see above). The whole paper is summed up in this part, as follows:

1. The 12 reasons given for creating a voluntary blood donors' association in every city or important town are more than enough to show how important they are from a medicosocial point of view, not only for the town where they function but for the whole country and even neighboring countries.

2. The 15 suggestions made for the better foundation and working of each association by itself and the whole as a body are very important from every point of view. If they are carried out in all existing and future associations, prestige will be enhanced and a standard organization with others in the country will result.

3. The author's services are offered unconditionally to the mayors of all the cities in the country and their health authorities, in collaboration to carry out the suggestions made in this paper.

**Ezeyza, S.: Synopses of the Present State of Knowledge of Cancer, Chapter IX (Conclusion): Factors which Alter the Development of Cancer when the Tumor is Already Present, Including Human Treatment,** Semana méd. 103:849, 1953.

The action of factors prior to the appearance of the tumor were dealt with in Chap. III. (Rev. Cap. Argentino 2:174, 1953). All kinds of malignant tumors are included as is every histological type; factors may be accessory, inhibiting and inert. Each group is minutely discussed, with especial emphasis on the inhibiting group, which has been used in treatment of human beings. This extensive work on cancer closes with general remarks and a bibliography for the nine chapters, comprising 9 books and 78 original papers.

**Mosca, L. G.: Roentgentherapy for Bone Tumors,** Prensa méd. argent. 41:434, 1954.

The indication depends on the sensitivity of the tumor to roentgen rays, but results *do not always agree with this general premise.* The most radio sensitive bone tumors are also the most malignant, the most invasive and the most quickly metastastic. Irradiation rapidly suppresses the primitive bone tumor, but metastasis in lung and bone are not long in appearing.

1. *Benign tumors. These should be excised* (bone cysts, osteoma, and nonossifying fibroma of bone, mistakenly believed to be a variety of osteoclastoma, which is of the nature of xanthoma).

2. *Hemangioma of bone.* The results of irradiation are 72.7 per cent favorable.

3. Osteoclastoma. Preferably treated by irradiation (87 per cent). Recidivation is less frequent when irradiation is combined with operation.

4. Chondroma; adamantinoma. Surgical treatment is advised.

5. Chondrosarcoma. Should have surgical treatment; merely palliative irradiation for chondrosarcomas of the pelvic bones.

6. Osteoblastic sarcoma. Used to be considered *resistant: operation was advised, but* results are poor. Combined treatment no better.

7. Ewing's sarcoma. Roentgen-sensitive. Prognosis bad from early bone and lung *metastases.* Roentgentherapy, however, is the treatment of choice.

8. Reticulosarcoma. The prognosis fairly good. The only treatment is irradiation, which cures 43 per cent.

9. Plasmocytoma. The prognosis is definitely bad, but irradiation is the treatment of choice.

**Oñativia, A.: Use of Regitine in Patients with Arterial Hypertension as a Diagnostic Test of pheochromocytoma,** Prensa méd. argent. 41:258, 1954.

In a group of 45 patients, 50 Regitine tests for pheochromocytoma were made. In 44 patients the result was negative, i.e., there was no significant pressure drop as observed in hypertensive patients with pheochromocytoma. There was 1 false positive result in a female patient, who had paroxistic hypertension and in whom the existence of a functioning chromaffin tumor was never confirmed. The hypertension was neurogenic or diencephalic. Intravenous injection of the drug was well tolerated, and intolerance is not an obstacle to routine use.

**Finochietto, R., and Yoel, J.: Lesions from Injections in the Gluteal Region,** Anales de Cirugia. 12:507, 1953.

The problem of patients for one or more fistulas, with chronic painful swellings in the gluteal region, evidently caused by so-called intramuscular injections, is discussed in detail.

The types of lesion present in such cases are described, and the operations performed, for both acute and chronic conditions, are illustrated with 10 drawings.

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ASSOCIATE SECRETARIES—Various Countries

CONTENTS—OCTOBER, 1954

R Surgical Significance of the Anorectal Musculature ........................ 367
*R. V. Gorsch, M.D., F.A.P.S., F.I.C.S., New York City, New York, and Urban R. Finnerty, M.D., D.A.B.P., F.I.C.S., Montclair, New Jersey*

The Degenerated Lumbar Disc: Treatment by Fusion of Vertebral Body............ 375
*Ralph B. Cloward, M.D., F.A.C.S., F.I.C.S., Honolulu, Hawaii*

Congenital Tracheoesophageal Fistula in the Adult ........................ 387
*K. P. S. Caldwell, M.A., F.R.C.S. (Eng.), F.I.C.S., Exeter, England*

Urologic Problems of Interest to the General Surgeon .. ... ......
*George H. Ewell, M.D., F.A.C.S., F.I.C.S., D.A.B.U., M*

. Venous Cavernoma of Fibula, So-Called "Aneurysmal Bone Cyst": Report of a Case. 401
*Alfred Haas, M.D., and Saul Alfred Ritter, M.D., F.A.C.S., New York City, New York*

ancer of the Thyroid: Evaluation of Results in a Recent Series .................. 408
*Cornelius B. DeCourcy, M.D., Cincinnati, Ohio*

nnular Pancreas .............................................................. 414
*Samuel Skapinker, M.B., B.Ch. (Rand), F.R.C.S. (Edin.), F.I.C.S., Johannesburg, South Africa*

'otal Colectomy: Indication and End Results ..................................... 422
*A. T. Eaton, M.D.C.M., F.I.C.S., Hamilton, Ontario, Canada*

'arcinoma in Situ: What is the Practical Therapy? ............................... 425
*Gilbert F. Douglas, M.D., F.A.C.S., F.I.C.S.; George Capers Douglas, B.S., M.D.; William W. Douglas, B.S., M.S., M.D.; Gilbert F. Douglas, Jr., B.S., M.D., and Sarah Frances Douglas, B.A., B.S., M.S., M.T., Birmingham, Alabama*

'arcinoma in Situ of the Uterine Cervix: Report of a Case Observed Over Two and a Half Years ........................................................................ 433
*Jacob Dissick, M.D., F.I.C.S., Brooklyn, New York*

'apillary Cystadenocarcinoma of the Pancreas .................................... 440
*Lorne W. Mason, M.D., F.A.C.S., A.I.C.S.; E. R. DeGiorgio, M.D., and F. L. McGrath, M.D., Evanston, Illinois*

. Forgotten Cause of Infant Suffocation: The Possible Relation between Atresia of the Posterior Nares to Asphyxia Neonatorum and Sudden Infant Death .......... 447
*Henry H. Beinfield, M.D., F.I.C.S., Brooklyn, New York*

ncidence of Acute Appendicitis .................................................. 456
*Lawrence S. Mann, M.S., M.D., F.A.C.S., F.I.C.S., and Franklin P. Friedman, M.D., Chicago, Illinois*

'he Vitellium Sphere Prosthesis for Nonunion of the Navicular Bone ............... 459
*John W. Metcalfe, M.D., Carlsbad, California*

ECTION ON OPHTHALMOLOGY AND OTORHINOLARYNGOLOGY

Repair of Cleft Palate by the Bone Flap Method: Group Evaluation of Cases ..... 463
*Lyndon A. Peer, M.D., F.A.C.S., F.I.C.S.; Robert Hagerty, M.D.; F. S. Hoffmeister, M.D., D.D.S., and Michael B. Collito, D.D.S., Newark, New Jersey*

Ear Reconstruction with Semilumar Knee Cartilage Preserved by Deep Freezing (Preliminary Report) ................................................................ 473
*L. H. Backus, M.D., F.A.C.S., Buffalo, New York*

ECCIÓN EN ESPAÑOL

Nefrectomia Parcial per Tuberculosis ............................................ 477
*A. Puigvert, M.D., F.I.C.S., Barcelona, Spain*

Instrumental Para Cirugia Vascular Flebodisector ................................. 487
*Carlos Alberto de Pierris, M.D., F.I.C.S., Buenos Aires, Argentina*

DITORIAL

Semmelweis and the Struggle for Truth ............................................ 489
*James S. Brailsford, M.D., F.R.C.P., F.I.C.S. (Hon.), Birmingham, England*

NEW BOOKS ........................................................................ 494

BSTRACTS FROM CURRENT LITERATURE ................................................. 496

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# Original Articles

## Surgical Significance of the Anorectal Musculature

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THE purpose of this presentation is to discuss the important anatomic relations of the anorectal musculature to surgical treatment of the more common anorectal conditions.

*Hemorrhoidectomy.* — Over the ages, hemorrhoidectomy has been done with less regard for the anatomic aspects of the anorectal region than almost any other surgical procedure. This fact has probably been responsible for the endless variety of new and sometimes bizarre technics advocated for this common and ancient disorder.

The *subcutaneous external sphincter* and the *conjoined longitudinal muscle* and its extensions are the two important muscles in hemorrhoidectomy (Fig. 1). Satisfactory hemorrhoidectomy requires adequate exposure of the anal canal. Anal fibrosis, pectinosis, or the pectin band commonly associated with hemorrhoidal disease usually involves the *subcutaneous external sphincter* muscle and prevents complete exposure. Posterior sphincterotomy, including incision and excision of anal fibrotic areas, then becomes an important part of hemorrhoidectomy. Neither specula nor anal retractors nor divulsion is a substitute for sphincterotomy.

Denudation of the transitional zone of the anal canal, with high stripping of the hemorrhoidal stumps above the dentate line, has been [illegible]ble for

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Submitted for publication March 24, 1953.

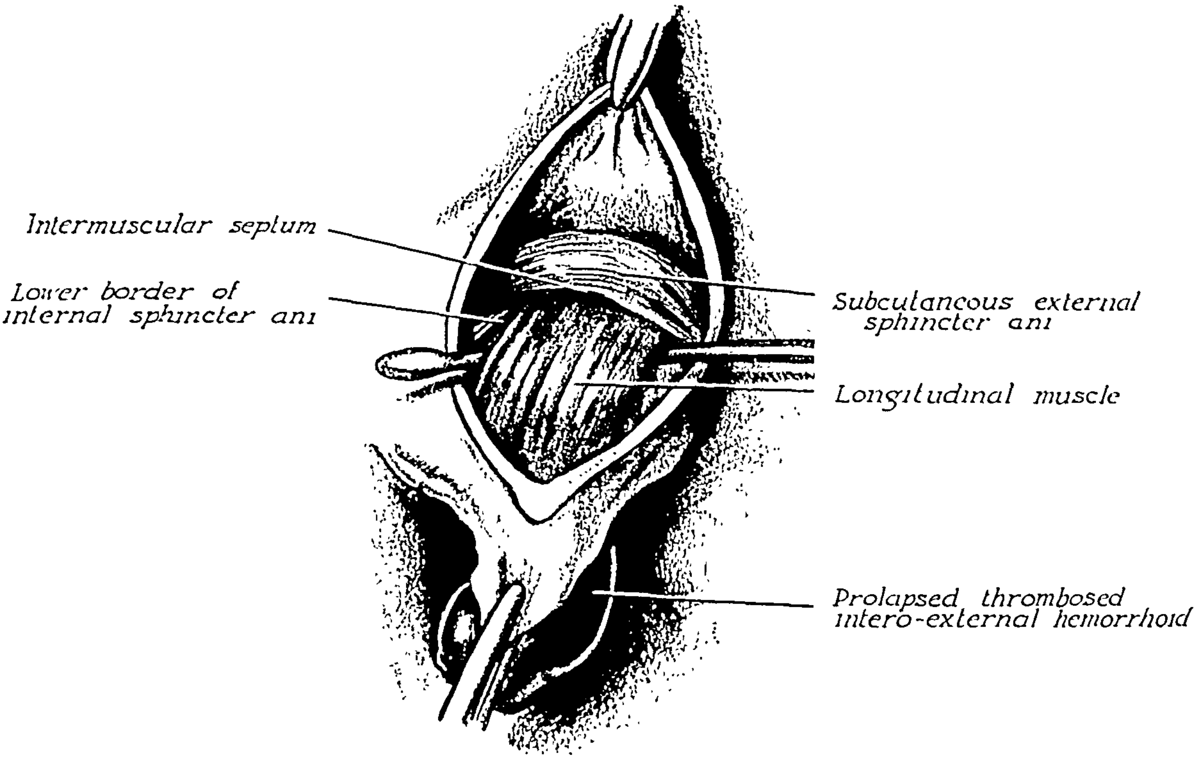
Intermuscular septum
Lower border of internal sphincter ani
Subcutaneous external sphincter ani
Longitudinal muscle
Prolapsed thrombosed intero-external hemorrhoid

Fig. 1.—Anatomic sketch showing prolapsed thrombotic hemorrhoid in relation to the muscles of the anal area.

undesirable complications of hemorrhoid operations. This zone, covered by the anoderm, lies directly in the grasp of the sphincters and contains a highly sensitive area adjacent to the dentate line. The *subcutaneous external sphincter* muscle marks the lower boundary of the transitional zone, and adequate exposure of the muscle, therefore, becomes one of the more important steps in the hemorrhoidal technic, regardless of minor modifications. In general, hemorrhoidal pedicles should preferably be tied off at the lower level of the *subcutaneous external sphincter* muscle. Milligan and Morgan, and more recently Blaisdell, have described hemorrhoidal ligature technics in which a minimal denudation of the transitional zone is an essential factor (Fig. 3). The postoperative course of hemorrhoidectomy may be aggravated by protracted spasm of the *subcutaneous external sphincter* muscle, which tends to retard healing and predisposes to pain, edema, infection, thrombosis and excessive scarring. When these common undesirable conditions are anticipated because of poor drainage or excessive muscular spasm, posterior sphincterotomy with adequate skin drainage is indicated. A posterior sphincterotomy may be of more significance to subsequent asymptomatic defecation than is removal of the hemorrhoids.

The extensions of the *conjoined longitudinal muscle* into the intermuscular septum, through the *subcutaneous external sphincter* muscle and into the perianal skin, form an integral part of the entire anal sphincter mechanism. The important complementary action of the pubococcygeus and puborectalis muscles in defecation is effected through these extensions. They retract the internal hemorrhoidal annulus after defecation and, in addition, form its more important supportive matrix. An essential point in hemorrhoidectomy is preservation of the conjoined longitudinal extensions below the level of the intermuscular septum. The guide to these extensions is adequate exposure of the subcutaneous muscle (Figs. 1 and 2). Their inclusion in the transfixion of the hemorrhoidal pedicle prevents high retraction of the stump and the undesirable denudation of the anal canal and sphincteric or terminal rectum (Fig. 3). Unnecessary destruction of these extensions, moreover, may cause dysfunction in the mechanism of defecation, with undesirable and sometimes intractable sensory disturbances. The untoward sequelae of the old Whitehead hemorrhoidectomy, which completely circumcises these extensions, are too well known to require further comment.

*Fissure: The Anal Sphincters in Fissurectomy.*— The *subcutaneous external sphincter* muscle is the structural cause of anal fissure, because of its annular arrangement and its fixation by the extension of the conjoined longitudinal muscle. Fissure initially involves the anoderm, which ruptures at or near the posterior median edge because it is fixed at this point by the *conjoined longitudinal extensions* and the *subcutaneous external sphincter* muscle, and not because this is a weak spot in the anal canal (Fig. 4). Infection, anal spasm, fibrosis and pectinosis are complementary etiologic factors. The precipitating cause is usually excessive straining provoked by a fecal mass that cannot accommodate itself to the anal marginal outlet. The so-called weak spot explanation for the posterior location of fissures would tend to be refuted by the fact that complete division of the *subcutaneous external sphincter* muscle, which usually cures the fissure, could scarcely be interpreted as strengthening the posterior anal tissues. Complete division of the subcutaneous external sphincter in the

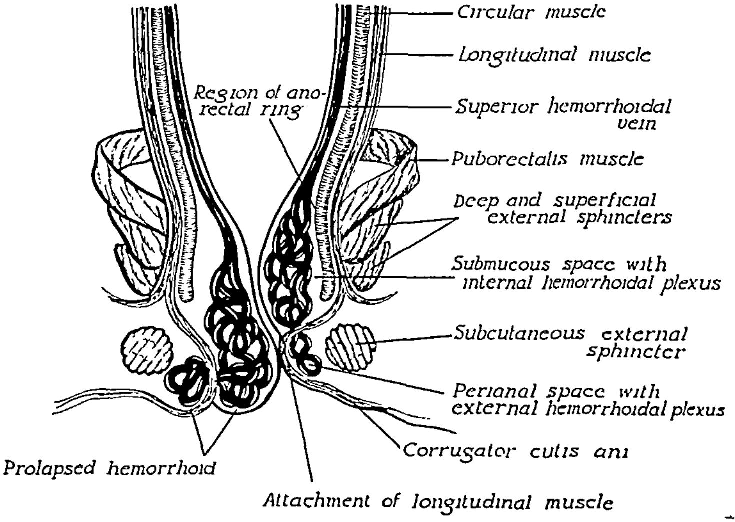
Circular muscle
Longitudinal muscle
Region of anorectal ring
Superior hemorrhoidal vein
Puborectalis muscle
Deep and superficial external sphincters
Submucous space with internal hemorrhoidal plexus
Subcutaneous external sphincter
Perianal space with external hemorrhoidal plexus
Corrugator cutis ani
Prolapsed hemorrhoid
Attachment of longitudinal muscle

Fig. 2.—Musculature of anal area.

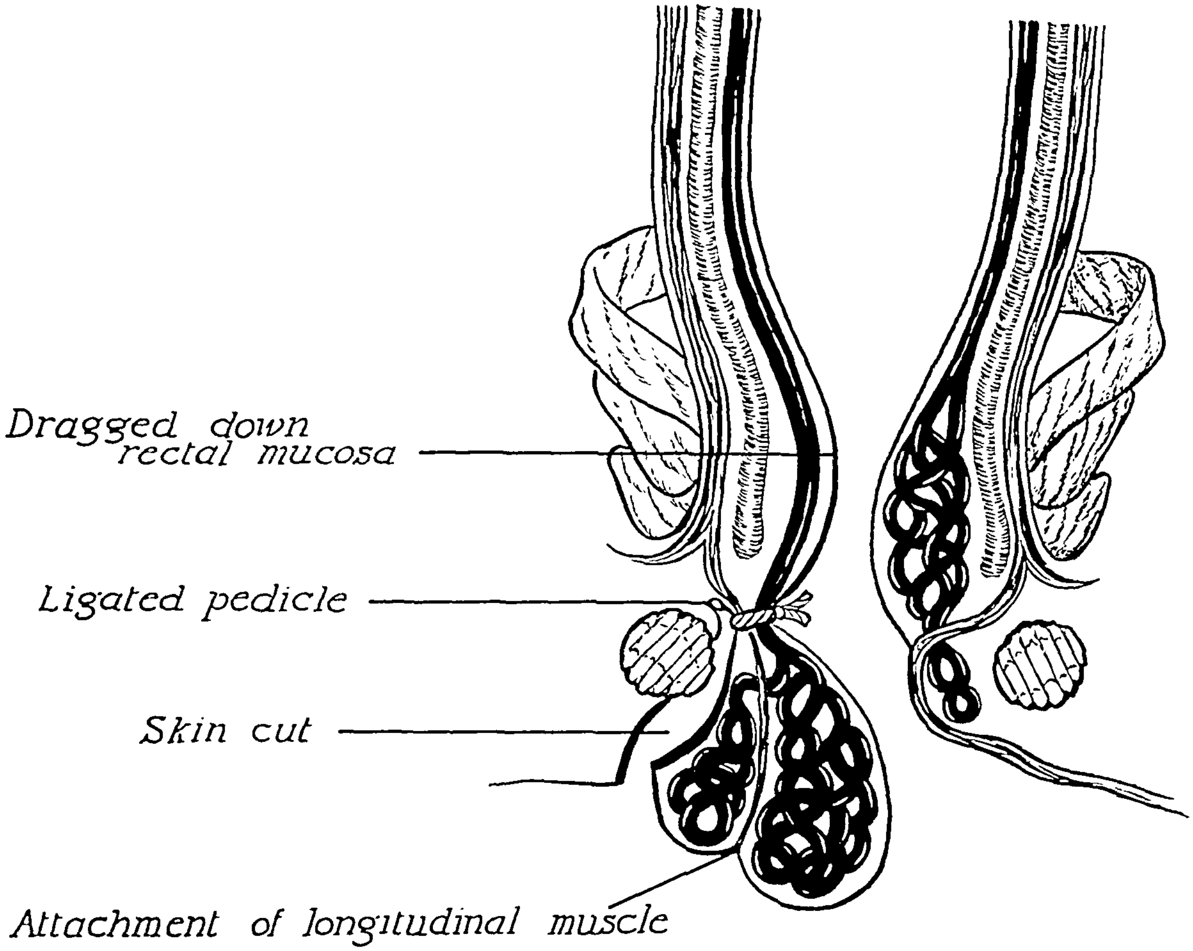

Fig. 3.—Transfixion of pedicle (see text).

posterior commissure is usually the minimal surgical treatment for the complete relief and nonrecurrence of the chronic anal fissure. This permits descent and flattening out of the anal musculature without overdistention of the posterior marginal anoderm. It is important to divide or dissect out the anal fibrosis as indicated in connection with sphincterotomy.

*Anal Stenosis (Contracted Anus).*—The anorectal musculature in this condition is more or less adherent to the scarred anoderm and rectal mucosa. The rigid anal outlet is limited in both dilation and contraction, and the mechanism of defecation may become highly obstructive and painful. The *subcutaneous external sphincter* muscle, owing to its annular arrangement and fixation, accounts for the greater part of the stenosis.

Since the landmarks of the anal musculature are usually obliterated in the presence of anal stenosis, the operation must be done on the recognition of the puborectalis sling, or anorectal muscle ring (Figs. 2 and 4). Satisfactory results usually demand complete division of the fibrous tissue and musculature up to the lower posterior margin of the anorectal muscle ring. The incision is best carried out under digital control and followed by adequate posterior triangular skin drainage. The extreme sacral end of this drainage wound should be on the same level as the puborectalis muscle (anorectal muscle ring).

Suture of the rectal mucosa, well freed up on either side, to the lateral and median edges of the incision often facilitates healing, provides a mucosal surface and improves the elasticity of the "new" anal canal.

The common causes of the recurrence of anal stenosis are: (1) failure to divide the anal fibrosis completely up to the puborcetalis muscle; (2) failure to establish adequate posterior skin drainage, and (3) inadequate postoperative care.

Unrelieved anal stenosis may lead to an intractable neurosis.

*Fistula.* — The *subcutaneous external sphincter* and the *puborcetalis* and *pubococcygeus portions* of the levator ani muscle are highly significant in the pathogenesis and surgical treatment of anorectal fistula. Operation for anal fistula is too commonly done on the basis of an erroneous concept of the anorectal musculature, with failure to evaluate the relative importance of the several muscular strata in relation to anal continence. Poor results in the surgical treatment of fistula, especially of the recurrent variety, may be partly explained on this basis.

Since it is very difficult, if not impossible, to identify the individual strata of the external sphincter at operation, the amount of anorectal musculature divided should be done on the basis of two well-defined and permanently palpable landmarks, namely, the anal intermuscular septum (anal attachment of the conjoined longitudinal muscle, Figs. 1 and 2) and the anorectal ring (Fig. 4). It has been repeatedly confirmed that preservation of a small but complete portion of this ring will allow control of normal feces. Its positive identification is of first importance in operations for high level anal and/or anorectal fistulas. The crux of a successful operation for fistula is the determination of the precise relation of the main tract and its primary or internal opening to the anorectal muscle ring and the intermuscular septum. On this concept, fistulas are anatomically classified thus:

1. Subcutaneous or submucous—5 per cent

2. Low anal—75 per cent

(The tract enters the anal canal at or below the intermuscular septum.)

3. High anal—15 per cent

(The tract enters the anal canal above intermuscular septum but below anorectal ring.)

4. Anorectal—5 per cent

(The main tract extends above the anorectal muscle ring, and the internal opening may be above or below it.)

The descriptive terms "complete," "incomplete," "blind," "internal" and "external" as applied to fistulas are of secondary importance.

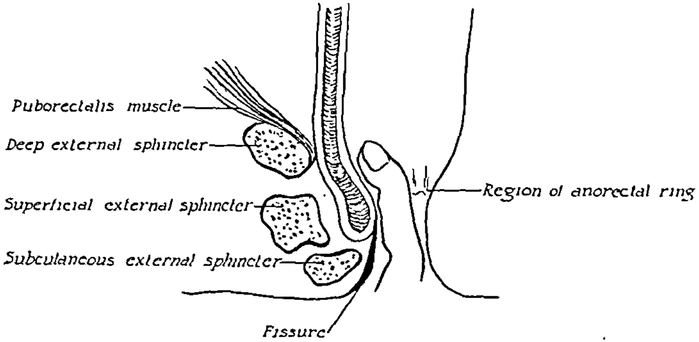

Fig. 4.—Muscles in relation to anal fissure.

tomia e chirurgia nella cura di tutte queste affezioni.

### ZUSAMMENFASSUNG

Die Verfasser erörtern die chirurgische Bedeutung der anorektalen Muskulatur in der Behandlung von Hämorrhoiden, Fissuren, anorektalen Stenosen, Fisteln, Inkontenenz des Afters und Mastdarmkarzinomen. Die engen Beziehungen der chirurgischen Gesichtspunkte und der anatomischen Verhältnisse bei der Behandlung dieser Erkrankungen werden hervorgehoben.

### RESUMEN

Los autores discuten la musculatura anorrectal desde el punto de vista quirúrgico, ratando sucesivamente el tratamiento quirúrgico de las hemorroides, fisura, estenosis anorrectal, fístula, incontinencia anal y carcinoma del recto. Se señala la correlación de los aspectos anatómicos y los quirúrgicos en el tratamiento de estos padecimientos.

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A man of sterling worth and great intellect, and who is known as such, is not ugly, even if his features are ever so irregular. And if he is indeed the reverse of good-looking, this does not impress one disagreeably.

—*La Bruyère*

# The Degenerated Lumbar Disc: Treatment by Vertebral Body Fusion

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TWENTY years have passed since the original description of the ruptured disc syndrome by Mixter and Barr.[1] One would expect the problems of a new clinical entity to be completely worked out in that period, particularly with the voluminous accumulation of medical literature on the subject. This, unfortunately, is far from true. Both neurosurgeons and orthopedic surgeons are still finding many patients whom they are unable to cure by the conventional surgical procedures employed for the disc lesion. Surgeons who do a considerable amount of surgical treatment of the disc, by whatever surgical method, are frank to admit that the patient who is most likely to get a poor surgical result is the one with the *so-called degenerated disc.* Neurosurgeons, as a rule, advise against cutting into a disc that does not show rupture of the annulus with intraspinal herniation of disc fragments.[2] Orthopedic surgeons note the highest percentage of failure (to relieve back pain) in spinal fusion operations for the collapsed disc.[3]

It is the purpose of this communication to present a study of a series of degenerated intervertebral discs. The pathologic picture with regard to the disc is evaluated in relation to the history of trauma, the clinical symptoms, the age and sex of the patient and the roentgen observations. A method of surgical treatment is described, which in my hands has given results far superior to those obtained by any other surgical method.

*Material.* — The study comprises patients operated on by myself during the latter part of 1951, 1952 and 1953: a total of 128. This group was chosen for study because each patient was given exactly the same preoperative workup, and underwent the same operative procedure and the same postoperative care. Each has been closely followed postoperatively to the time of writing (April 1954) to determine the end results. For statistical purposes, more valuable conclusions can often be drawn from study of a small group of well worked up cases than from a large series in which the information on many is incomplete.

*Mechanism of Production of the Degenerated Disc; Pathologic Picture.* — The intervertebral disc is composed of the cartilagenous plates, the annulus fibrosus and the nucleus pulposus. The last-mentioned structure, a remnant of the embryonic notocord, is a soft gelatinous mass in the center of the disc, with the noncompressible properties of a liquid. The laminated fibrous layers of the annulus maintain the nucleus in a globoid shape when it is confined under pressure, acting as a shock absorber between the vertebral bodies.

The shift of weight bearing caused by change of position of the spinal column changes the shape and position of the nucleus, thus exerting greater pressure on the annulus. Acute rupture of the fibers of the annulus may occur if sufficient force
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Read at the Ninth International Congress of the International College of Surgeons, Sao Paulo, Brazil, April 26-May 2, 1954.

Submitted for publication June 15, 1954.

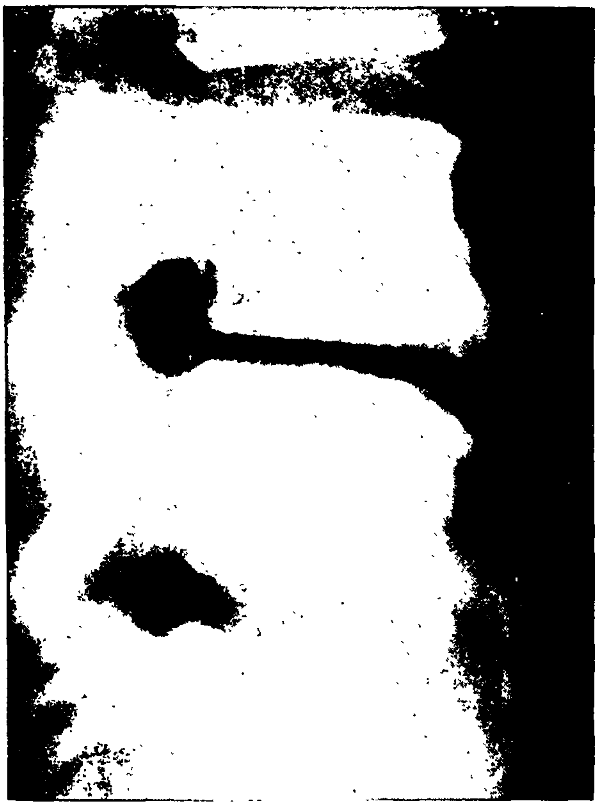

Fig. 1.—Thin degenerated disc at L3-4 with large osteophyte in a man, aged 49, who had suffered severe back pain for twelve years.

of degeneration of the vertebral disc.

Key[4] has suggested three possible mechanisms responsible for the degeneration of an intervertebral disc: 1. Internal friction of the oblique and interlacing fibers of the annulus on one another in the various twisting movements of the spine may cause these fibers to degenerate. 2. The remoteness of the nucleus and central fibers of the annulus from their blood supply make for lowered metabolism of tissue cells, which may result in degeneration during periods of tissue starvation. 3. Even though the normal healthy disc withstands tremendous traumatic insults, acute violent trauma or continued minor stresses may weaken it and lead to eventual rupture followed by degenerative changes with collapse, possible herniation and absorption.[5]

Horwitz[6] studied the cadavers of 75 persons between 45 and 90 years of age. He observed 50 with pathologic changes in the lower three lumbar levels, characteristic of the degenerated disc. In these, the intervertebral space was narrowed. There was fibrillation, fragmentation of fibrocartilage and dehydration, often associated with brown pigmentation of the nucleus pulposus. Various degrees of lipping and spur formation were observed along the vertebral margins. In all 50 cases there was posterior bulging of the disc into the spinal canal, but in only 4 cases was there actual herniation of disc material. In a series of 100 cases reported from the Mayo Clinic in May 1940,[7] microscopic study failed to reveal notocordal tissue (nucleus pulposus) in 85 per cent, indicating degeneration and absorption of this structure. An excellent comparison of the clinical symptoms with the pathologic changes observed in cases of degenerated disc was made by Sashin[8] in 1936.

*Roentgen Examination.*—A degenerated intervertebral disc is usually diagnosed by roentgenographic observation of a narrowed intervertebral space (Fig. 1), with or without marginal osteophytes on the adjacent vertebral bodies. This evidence is augmented by contrast medium studies, myelographic and discographic, to determine the anatomopathologic character of the disc itself.

The roentgenograms of the 128 patients in this series were carefully studied to establish criteria for discs that could be classified as degenerated. Preliminary films were obtained of each patient in the horizontal position (to eliminate the effect of weight bearing on the size of the disc). The anterior and posterior widths of the third, fourth and fifth intervertebral spaces were measured on the lateral projection. The normal and pathologic discs were distinguished discographically.[9] The discs that showed an intact nuclei pulposi on discographic examination were measured. For the 151 normal discs the measurement was 10 mm. for the posterior and 14 mm. for the anterior width of the interspace. The respective maximum and minimum normal widths were: anterior, 17 mm. and 10 mm.; posterior, 10 mm. and 6 mm.

The narrowed interspaces observed in the pathologic discograms (Fig. *2B*) were measured. Any interspace measuring less than 9 mm. anteriorly and 5 mm. posteriorly was considered to represent a degenerated disc.

Disc spaces as thin as 2 mm. (Fig. *3A*) were observed, *and others just under the* normal minimum were shown by the discogram to have the characteristic features of a degenerated disc. The narrowest interspaces were observed in patients who had had symptoms referable to the back for five years or longer. The average measurements for 8 female patients in this group were respectively 7 mm. and 4 mm.; those for 13 male patients, 9 mm. and 6 mm.

*The discogram is of inestimable value* in establishing the presence of a degenerated disc.[9] Visualization of the interior of the disc by needle puncture and injection of a radiopaque water-soluble dye not only indicates whether the disc is normal or ruptured but shows extent and degree of rupture—the anatomopathologic picture *of the abnormal disc. With loss of the* nucleus pulposus the fibers of the annulus are ground together, further torn and disorganized. These torn recesses of the disc are filled with the dye in the discogram, and in the roentgenograms the dye is seen to fill the interspace completely (Fig. *2A*), often extending beyond it. A not infrequent configuration of the dye is a balloon*like extension anterior to the interspace* (Fig. *4A*). This obviously represents either (a) an anterior herniation of the disc material beneath the anterior longitudinal ligament[10] or (b) redundancy or relaxation of this ligament resulting from loss of the expansible force of the nucleus pulposus, which normally keeps it taut. Ostophyte formation at the vertebral margins follows the convex contour of this bulging ligament. (Discograms taken with *the patient in the upright position* and the spine in flexion and extension often demonstrate the protrusion of the degenerated disc.)

On the degenerated disc without herniation the myelogram will often give misleading information. For this reason, I prefer the discogram. In the myelogram, the *characteristic defect in the pantopaque* column is an hourglass configuration in

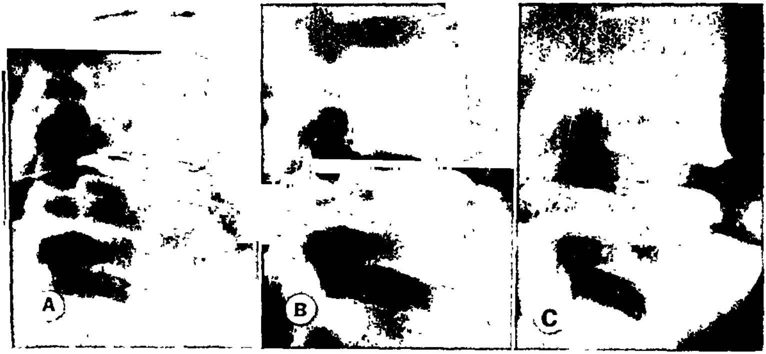

Fig. 2.—Degenerated disc at L4-5 in a 38-year-old woman, a concert pianist. Back pain nine years. Right sciatica one year caused her to give up piano. *A*, discogram showing complete ruptu Posterior, anterior and superior herniation. (Note defect in superior cart us p *B*, disc at L4. *Normal interspace above and below.* Small osteophytes. *C*, r t and one-half months after operation, Interbody fusion with approxima *tient symptom-free and playing the piano*

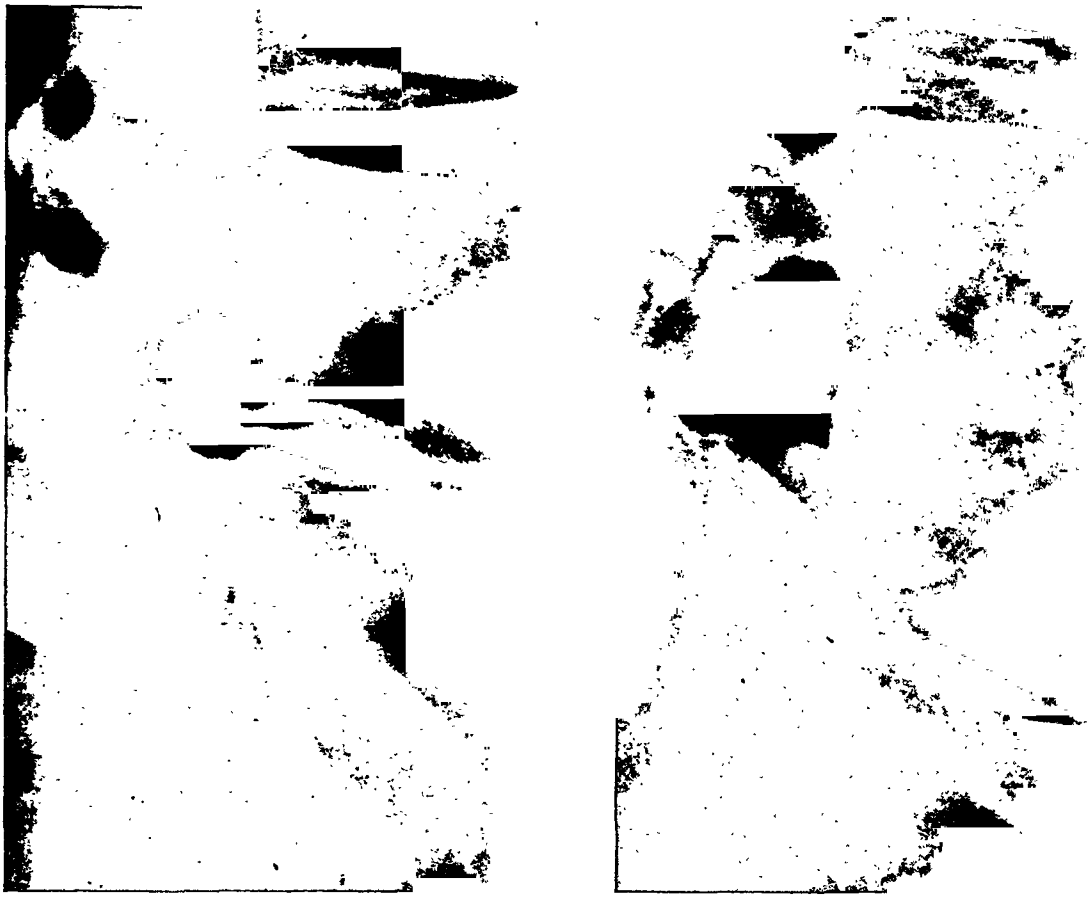

Fig. 3.—Marked degeneration of L4 disc in a 57-year-old nun. Symptoms of back pain and bilateral sciatica for six years. *A*, extremely narrowed interspace, straight (poker) spine, overriding of facets; narrow intervertebral foramen; absence of osteophytes; normal interspace above and below. *B*, film taken six months after the operation, showing complete interbody fusion. Note increased size of foramen. Complete relief of symptoms.

the anterposterior film and a shallow notch in the anterior surface of the column in the lateral view (Fig. *5A*). In the absence of posterior protrusion in a degenerated disc with extensive lateral and anterior disruption, the myelogram is normal and thus gives false diagnostic information. In such a case the patient is often informed that he does not have a ruptured disc to account for his low back pain and therefore surgical treatment is not indicated or advised.

With the discographic observations and the interspace measurements as criteria, 57 of the 128 patients were discovered to have 69 degenerated discs. In 34, or 50 per cent, these occurred at the lumbosacral level: in 20 (42 per cent) at the fourth lumbar disc, and in 6 (8 per cent) at the third lumbar level.

Multiple (2 or more) ruptured discs (Fig. 6) were diagnosed by discographic examination in 18 of the 128 cases (14 per cent). Of the 57 patients with degenerated discs, 12 had 2 ruptures and 2 had 3 ruptures (14, or 25 per cent). This higher incidence of multiple pathologic lesions in patients with degenerated discs suggests a possible constitutional weakness.

The next roentgenographic study was directed toward the osteophyte, or spur formation. The frequency and size of these bony proliferations on the vertebral margins adjacent to the degenerated disc was observed to determine their relation to the pathologic condition of the disc. It has always been assumed that local spur formation on a lower lumbar vertebra was pathognomic evidence of a ruptured disc.[11] It was a surprise to find that only 29 (42 per cent) of the 69 degenerated discs had osteophytes. At the third lumbar interspace, 3 of the 6 patients had spurs (50 per cent); at the fourth lumbar level, 13 of 29 patients (41 per cent) had spurs, and at the fifth lumbar level, 13 of 46 patients had spurs (35 per cent). With regard to size, the osteophytes were classified as small (Fig. *2B*), medium (Fig. *4B*) and large (Fig. 1). Eighteen (67 per cent) were considered small.

The duration of backache was compared with the presence of osteophytes at the level of the degenerated disc. Of patients who had had symptoms for one year or under, 14 had osteophytes and 13 did not. Of those with backache of one to five years' duration 3 had spurs and 6 had none; and of those with histories of backache over five years there were 12 with osteophytes and 9 without. Of the 57 patients, only 29 had osteophytes associated with the degenerated disc. The occurrence of spur formation was equal in the two sexes.

One may conclude from these observations that the vertebral osteophyte is not necessarily a part of the ruptured disc syndrome. The observation of large spurs adjacent to a normal disc, as shown by the discogram, would indicate that rupture and collapse of the disc is not necessary for their formation. The cause and treatment of "arthritic spurs" is the subject of another paper.[12]

*Clinical History.*—A careful survey of each patient's history was made to determine whether there was any relation between age, sex and duration of symptoms to the changes seen in the roentgenograms. Thirty-two per cent of the patients were female. In a review of 265 cases of disc operations prior to 1951, 25 per cent of the patients were female. As to age, patients in the thirties and forties comprised 70 per cent of those with degenerated discs, as compared to 48 per cent of the overall group. Twenty-one per cent of the patients with degenerated discs were past 50.

The location and duration of symptoms indicate that leg pain is almost as fre-

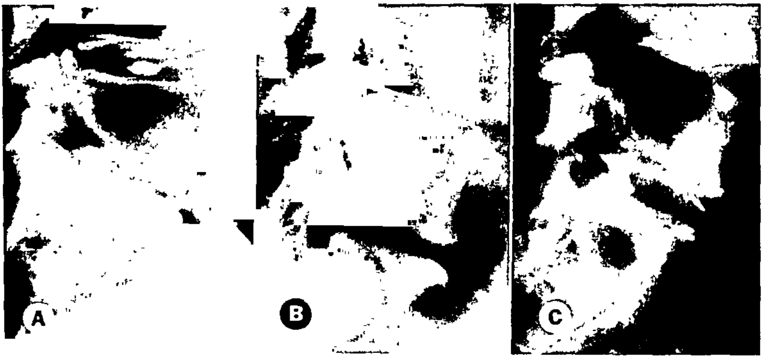

Fig. 4.—Degenerated L5 disc in 33-year-old Japanese fisherman. Back pain only two years. *A*, discogram showing complete degeneration of disc and collapse of interspace. Balloon of dye anterior to interspace represents anterior herniation of disc fragments beneath anterior longitudinal ligament. Flexion of spine markedly restricted. *B*, thin disc space, subarticular sclerosis and medium-sized local osteophytes at L5-S1. Note small intervertebral foramen. *C*, postoperative vertebral body fusion with wide interspace and foramen.

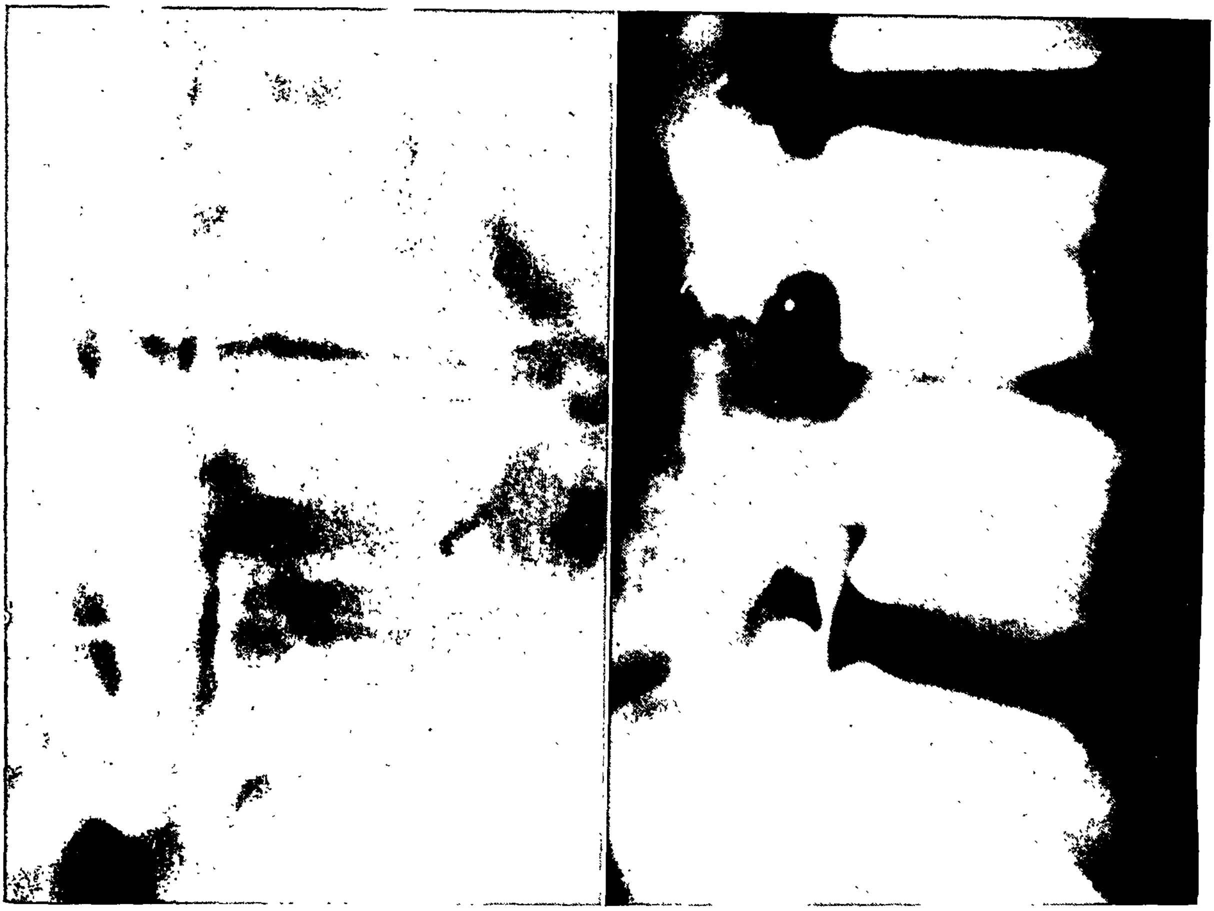

Fig. 5.—*A*, myelogram of degenerated disc at L3-4, outlining "flat tire" disc. *B*, marked subarticular sclerosis of half of vertebral bodies adjacent to degenerated disc.

quent as back pain. All patients complained of backache, whereas 48 of the 57 had leg pain, 10 of whom had bilateral sciatica. Backaches had been present for an average period of five and one-half years and leg pain for an average period of four years. The shortest duration of symptoms was two weeks; the longest, twenty-four years. Symptoms had been present slightly longer in female than in male patients.

These data indicate that a constitutional weakness of tissues may be a more important factor than trauma in the degeneration of the disc, since they occur more often in the female despite the fact that the male spine is subject to greater traumatic insults. In cases of acute rupture with severe symptoms (unilateral sciatica) the patient seeks medical aid sooner. Symptoms referable to degenerated discs are less severe, intermittent and chronic, existing for an average period of five or six years before they bring the patient to seek help.

The symptom pattern was also related to the level of the lesion. Only 1 of 6 patients with degenerated discs at the third lumbar level had leg pain. The absence of root pain with ruptured discs at this level has recently been explained[13] on the basis of the anatomic relation of the intervertebral foramen to the disc. The exit of the third lumbar nerve root is inferior to the disc, so that protruding disc is less likely to encroach upon the nerve. At the fifth lumbar level, on the other hand, the disc forms the anterior half of the intervertebral foramen, and any encroachment of the disc upon the spinal canal will come into contact with the nerve. Sciatica also is most common with ruptures at the fifth lumbar level, because anatomically the largest nerve root passes through the smallest foramen. In this series, 29 of the 34 patients with degenerated discs at the fifth lumbar level had unilateral or bilateral sciatica.

*Treatment.*—Treatment of a ruptured lumbar disc has been considered a neurosurgical problem since its original description. In reviewing large series of cases in which operation has been performed for pathologic discs, poor results are uniformly reported for patients with degenerated discs. Lewey[14] reported only 57 per cent of such patients relieved of their symptoms after surgical intervention. Spurling[14] has repeatedly stressed the fact that the simple bulging disc observed at operation should not be cut into but left alone. This decision was obviously arrived at through experience of poor surgical results. Because the patients with a degenerated disc were not cured by the conventional neurosurgical operation, they gravitated into the hands of the orthopedic surgeon. Spurling[15] stated that continued complaints of back pain (after removal of a herniated disc) is "an orthopedic problem."

Spinal fusion operations, however, have too high a percentage of failure, i.e., fail-

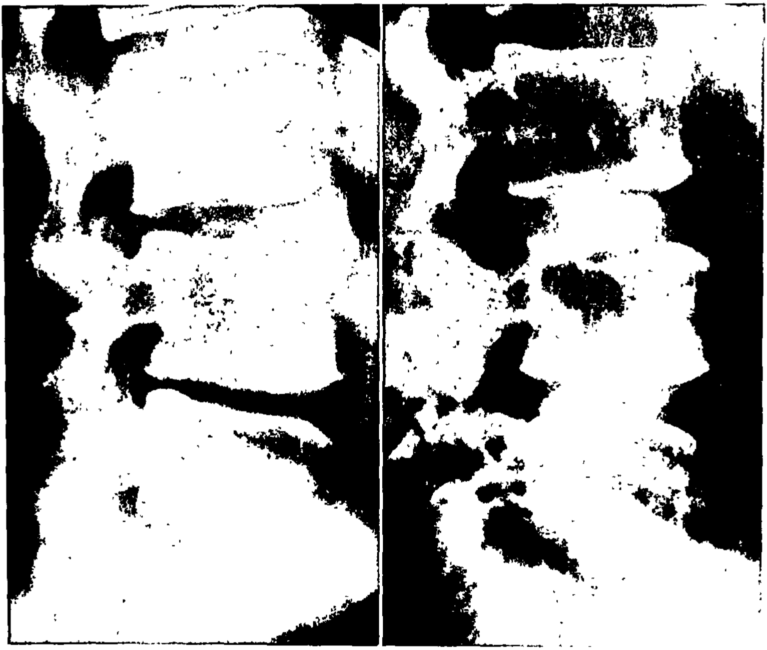

Fig. 6.—Double disc in a 31-year-old Chinese bookkeeper. Intractable back pain only, four years. *A*, *degeneration of two discs (third and fourth lumbar) verified by discogram.* Normal discs above and below. *B*, postoperative vertebral body fusion of two levels; interspaces and foramens restored to normal. Patient ½ inch (1.2 cm.) taller!

ure to relieve low back pain. This may occur whether fixation of the spine by fusion is successful or not. It is most distressing to the orthopedic surgeon to obtain a strong, roentgenographically verified spinal fusion and have the patient still incapacitated from intractable back pain, with or without sciatica. This experience occurs most often with the degenerated disc, especially at the lumbosacral level (Fig. 7).

A possible explanation of these poor results may be as follows: With collapse and degeneration of the lumbosacral ruptured disc, the intervertebral space narrows; the facets override; the intervertebral foramen, which is normally small, narrows farther, and the "flat tire" bulge of the disc protrudes into the foramen, reducing it still farther. The large fifth lumbar nerve roots are thus severely encroached upon at their exit from the spinal canal. At operation, if no soft loose mass of disc material is present, the neurosurgeon "refuses to cut into the bulging disc." The orthopedic surgeon then does a posterior (Hibb's) fusion, which becomes solid, immobilizing the joint. The nerve roots are then trapped by this fixation in the small foramen (Fig. *7B*, arrow) with the bulging disc compressing them. After the operation the patient continues to suffer from back pain and sciatica. I have reoperated in over 20 such cases, and the conditions were as described.

The rescue from this surgical dilemma is provided by fusion of the vertebral bodies. Since it is impossible for nature to restore the normal integrity of the disc once it is ruptured, an operative procedure that will reestablish the normal width of the intervertebral space, and at the same time immobilize the abnormal joint, will remove both causes of the patient's pain. Increasing the size of the intervertebral foramen by widening the interspace and decompressing the nerve by removing the bulging disc removes the cause of the leg pain. Solid fixation of a single joint by obtaining body-to-body fusion across the intervertebral graft removes the primary cause of the low back pain (Figs. *2C*, *3B* and *4C*).

*Vertebral Body Fusion.*—The technic of this operation has been described elsewhere.[16] Briefly, it consists of a bilateral partial hemilaminectomy with removal of part of the articular facets. After retraction of the nerve root and the dural sac with a special self-retaining retractor, and cauterization of the epidural vessels, a square block of the disc is cut out. Through this opening the entire intervertebral disc is removed, including the cartilaginous plates, down to the anterior longitudinal ligament. The cortical surfaces of the vertebral bodies are chiseled off in preparation for the bone grafts. These are large plugs of bone, full-thickness iliac grafts, obtained from a bone bank.[17] Two of these grafts are driven into the interspace on each side of the dural sac after the width of the space has been increased with a special instrument, "the vertebra spreader."[18] A posterior fusion is also included by covering the interlaminar operative defect and the adjacent lamina with fine bone crumbs.

The *postoperative* care and convalescence of the patient is simple and rapid. After six days in bed, he is encouraged to walk without back brace or cast. When he is able to do so with very little discomfort, he usually is ready to leave the hospital on the seventh or the ninth postoperative day! The average hospital stay for the 57 patients with degenerated discs was twelve and three-tenths days. This excluded 2 whose hospitalization was prolonged, owing to complications: one a wound infection associated with spondylolisthesis, and the other a severe reaction to penicillin in a female patient. The bone grafts, wedged forcibly between the vertebrae, mechanically fix the painful joint from the beginning. Placed at right angles to the weight-bearing axis of the spine, the grafts are wedged tighter together in the upright position. Early ambulation, therefore, is conducive to rapid fusion.

The *results* of this type of fusion are most gratifying to both surgeon and patient. Roentgenograms taken at monthly intervals have demonstrated solid fusions as early as two months, the average time is three and one-half months. Of the 57 patients, the roentgenograms demonstrated solid interbody fusions in 53. In the remaining 4 patients the intervertebral grafts were absorbed, with gradual settling of the interspace. Three of these, however, had strong posterior fusions and were symptom-free although convalescence was slightly prolonged. One patient required a second operation.

Symptomatically the patients were placed into two groups: (1) cured (symptom-free and returned to former occupation without disability) and (2) not cured: still complaining. Forty-nine patients placed themselves in Group 1. Six of the 8 patients in Group 2 were laborers drawing workmen's compensation, with litigations pending. One patient, with a third degree spondylolisthesis, acquired a unilateral foot drop but is improving. The second patient, a 58-year-old woman who had undergone two previous operations on the back, is still complaining. The symptomatic relief obtained in 85 per cent of these difficult cases, with the probability of a higher percentage later (when lawsuits are completed), is indicative of the value of vertebral body fusion in the treatment of degenerated lumbar intervertebral discs.

## SUMMARY AND CONCLUSIONS

1. In a recent series of 128 patients operated upon for ruptured discs, 57 were observed to have degenerated discs.

2. Criteria for classification as degenerated discs were (a) an intervertebral space measuring 4 to 5 mm. narrower than normal and (b) a demonstration by discogram of complete rupture of the disc.

3. Osteophyte formation was not an in-

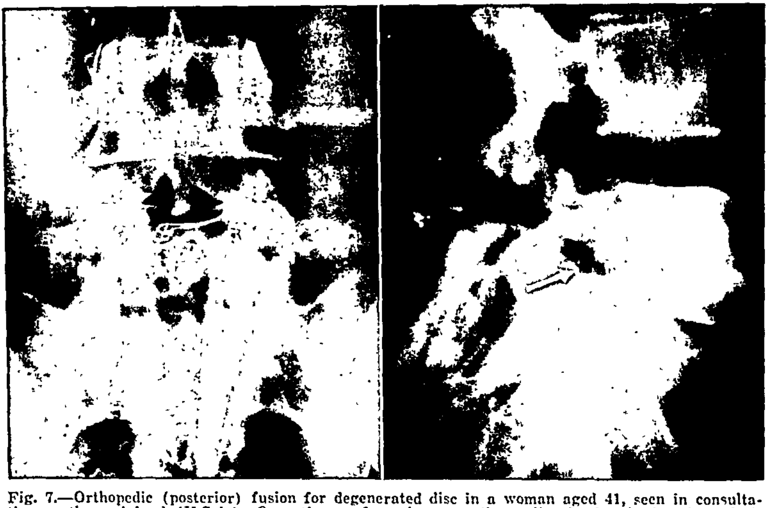

Fig. 7.—Orthopedic (posterior) fusion for degenerated disc in a woman aged 41, seen in consultation on the mainland (U.S.A.). Operation performed ten months earlier for low back pain and bilateral sciatic pain. Postoperative body cast four and one-half months; hospitalized six months. Still wearing back brace (nineteen months). Patient totally incapacitated with back and bilateral leg pain. *A*, solid posterior fusion of large tibial grafts across lumbosacral joint. *B*, arrow interspace and small foramen (arrow) in which nerve roots are "trapped."

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We hear people ask how it is that all men do not form a single nation, agreeing to speak one language, to obey the same laws, and adopt the same manners and customs and religion. For my own part, when I reflect upon the diversity of men's minds, tastes, and feelings, it is with wonder that I see as many as seven or eight persons living under the same roof and forming one single family.

—*Vauvenargues*

# Congenital Tracheoesophageal Fistula in the Adult

K. P. S. CALDWELL, M.A., F.R.C.S. (ENG.), F.I.C.S.

EXETER, ENGLAND

TRACHEOESOPHAGEAL fistula with atresia of the esophagus has received a great deal of publicity in the past few years, and is diagnosed of necessity in the newborn. When atresia does not exist, the condition is compatible with life; it is nevertheless rare in the adult, since the fistula leads to recurrent attacks of pneumonitis. Authors who have reported cases have usually stressed the simplicity of the repair, and the purpose of this paper is to present an additional case which conforms well with the majority so far as symptoms are concerned. Although the condition was diagnosed in life, the patient died before operation—perhaps fortunately, since the repair would have been an extremely difficult procedure.

## REPORT OF CASE

A man aged 54 had been in a mental hospital since the age of 16, with a diagnosis of imbecility. He could, however, read, write and could answer simple questions. Since his admission to the mental hospital a good record had been kept of all his illnesses; this was available to me and was most helpful in completing his medical background. In the family history there was nothing of note, save that his father died at the age of 44 of "carcinoma of the stomach" and one other relative, a greataunt, was mentally deficient. In 1925 the patient was reported to have had some respiratory trouble, with coughing and intermittent pyrexia. He was thought to be tuberculous, but all investigations gave negative results. The pyrexia lasted for five days and then cleared up. At varying times he was admitted to the sick bay with respiratory troubles. In October 1927 he lost 14 pounds (6.4 Kg.) in weight, and this led to a further full investigation. Nothing abnormal was discovered, and he quickly regained the lost weight. Between this date and October 1953 there were three other attacks of respiratory trouble sufficiently severe to be noted. In October 1953 it was observed that he vomited after meals. He had no abdominal tenderness: his nutrition was noted to be good, and an enema was ordered. This had no effect on the vomiting and a diagnosis of "intestinal obstruction (?)" was made. I was asked to see him at this date and noted that on drinking a glass of water he immediately vomited; but there was no cough and no dyspnea, and his general condition was quite satisfactory. The nurses stated that he belched frequently and thought that his condition was due to aerophagy. Since it was evident that he had no obstruction, at this stage a differential diagnosis was made between a neurologic condition and a tracheoesophageal fistula, and a barium swallow was ordered. This was performed in December (Fig. 1). The roentgenogram clearly showed a tracheoesophageal fistula with a patent esophagus, and at this time it was noted that the patient had actually gained weight. After the barium examination, however, severe pneumonia suddenly developed, and he died on Jan. 1, 1954, before any surgical treatment could be undertaken. A postmortem examination was carried out by Dr. Stewart Smith on January 3. The report mentioned the fact that the body showed good nourishment. The only abnormalities observed were as follows:

1. Lungs: Both lower lobes showed confluent bronchopneumonia of inhalation type.
2. One-third of the way down the anterior wall of the esophagus was a shallow depressed area measuring 2 cm., 1.5 cm., and from the bottom of this a probe could be passed into the trachea. The posterior wall of the trachea was in fact formed by the anterior wall of the esophagus, and there was no plane of cleavage between the two (Fig. 2).

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Submitted for publication June 15, 1954.

only on roentgen examination and second, the case described by Berman,[1] already mentioned. The symptoms are such that this condition should be diagnosed or at least suspected if the possibility is borne in mind. There are attacks of choking and coughing on drinking liquids, especially water, and this is even worse if the patient is prone, because in this position the fistula is dependent. These attacks lead to pneumonitis, which may be recurrent. In newborn infants the condition is very like neuromuscular incoordination, and this may be the first diagnosis made. In some cases it is thought to be recurrent pneumonitis or bronchiectasis, particularly if the fistula is intermittent, and investigation is confined to the pulmonary picture, so that the true condition is frequently left undiagnosed. The pneumonitis is sometimes thought to be due to a spillover from achalasia;[1] this would conform quite well with the symptoms.

If the condition is suspected, instead of a barium swallow it would be better to use an iodized oil for roentgen study. If there is no obvious fistula with the patient supine, he should be turned into the prone position and the investigation repeated. The fistulas may be intermittent or valvelike, as in the case reported here, and are sometimes difficult to demonstrate. Esophagoscopic and bronchoscopic studies should follow, but it is extremely difficult to see the fistula in some cases.

As a rule, the treatment generally de-

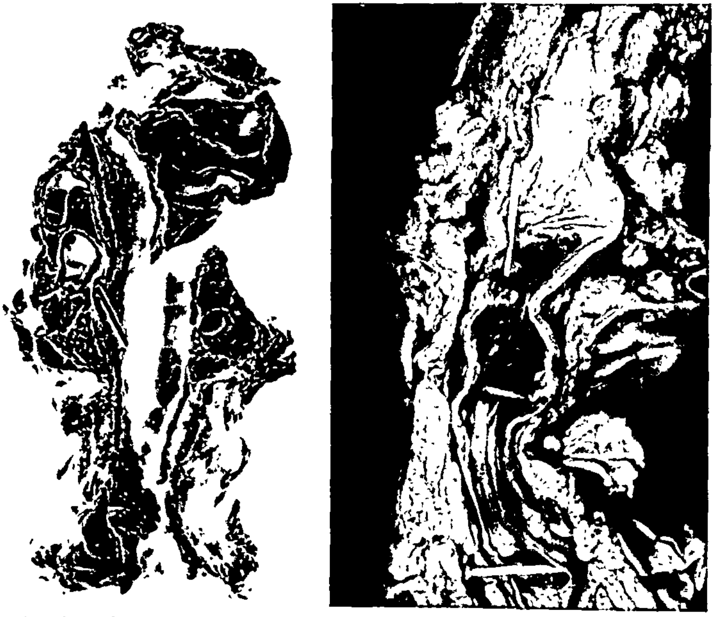

Fig. 2.—Anterior and posterior views of specimen showing the tracheoesophageal fistula and rod in the tract.

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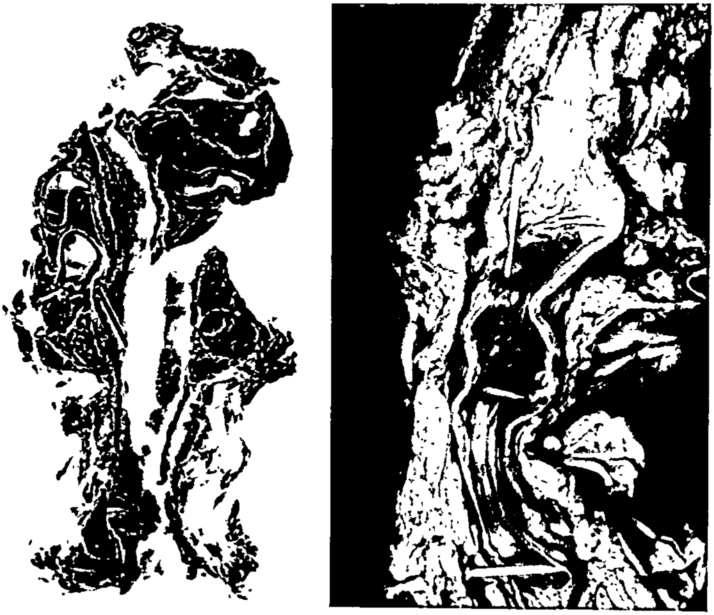

Fig. 2.—Anterior and posterior views of specimen showing the tracheoesophageal fistula and rod in the tract.

scribed has been applied to acquired fistulas. In reports of surgical treatment the ease of closing the fistula is usually stressed. In this case it would have been an extremely difficult procedure, since there was no plane of cleavage between the trachea and the esophagus. It is important in such cases not to wait for the pneumonitis to subside, and it has been stressed by most authors that the pneumonitis clears up with remarkable rapidity once the fistula has been closed. In an acquired fistula, beads of silver nitrate or sodium hydroxide crystals have been fused to a carrier and applied through an esophagoscope,[5] but in a case of congenital fistula, it is doubtful whether this would be of much use.

### SUMMARY

A case is described of a congenital tracheoesophageal fistula occurring in an adult aged 54. Diagnosis was made during life, but the patient died before any operative repair was attempted.

*Author's Note*: I should like to thank Dr. G. Stewart Smith, Area Pathologist, who performed the autopsy, for his report, and Mr. C. O. Dyson for the photographs of the specimens.

### RÉSUMÉ

Description d'un cas de fistule trachéo-oesophagienne, chez un homme de 54 ans. Le diagnostic fut posé mais le patient décéda avant l'intervention chirurgicale.

### ZUSAMMENFASSUNG

Es wird ein Fall einer angeborenen Fistel zwischen Luftröhre und Speiseröhre bei einem 54-jährigen Manne beschrieben. Die Diagnose wurde bei Lebzeiten gestellt, der Kranke starb aber, bevor ein Versuch chirurgischer Korrektur unternommen wurde.

### RESUMEN

Se comunica un caso de una fístula traqueoesofágica congénita en un hombre de 54 años de edad. El diágnostico se hizo durante la vida, pero el paciente murió antes de intentarse cualquier reparación quirúrgica.

### CONCLUSIONI RIASSUNTIVE

Viene descritto un faso di fistola esofagotracheale in un uomo di 54 anni. La diagnosi fu posta clinicamente, ma il paziente morì prima di poter essere operato.

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> That life may be grand one must put in it the past and the future. Our works of poetry and art must be accomplished in honor of the dead and with the thought of those who are to come after us.
>
> —*Smith*

# Urologic Problems of Interest to the General Surgeon

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MADISON, WISCONSIN

IN this paper it is my intention to discuss only a few of the urologic conditions that may present perplexing problems to the general surgeon. I shall endeavor to restate the pertinent fundamental principles that should be recalled when one is confronted with the management of one of these conditions, some of which are not common. In making the presentation I shall also endeavor to keep in mind a thought suggested by Dr. John B. Deaver several years ago: "Even the most obvious things become impressive if repeated with sufficient sincerity and frequency."

Anuria is a rather common urologic problem of interest to the general surgeon. For practical purposes, a patient is considered anuric when the output of urine falls below 100 cc. in twenty-four hours. Any degree of anuria developing during the course of any illness, whether medical or surgical, or occurring as a result of an accident, is a serious condition; it is essential, therefore, that the cause or causes of its occurrence be carefully considered in order to apply the proper therapy.

During recent years attention has been directed to such conditions, and the clinical picture is referred to as characterizing the lower nephron nephrosis syndrome. The most common causes of the anuria are transfusion reactions, surgical shock, burns, crushing injuries and the ingestion of sulfonamide drugs.

Anuria following pelvic surgical intervention in the female calls for cystoscopic study and ureteral catheterization before it is assumed that the anuria is due to renal secretory failure.

The following case is rather typical of those in which anuria is due to circulatory, secretory and excretory factors:

Mrs. C. D., aged 52 (Fig. 1*A*), underwent a laminectomy for a ruptured nucleus pulposus. Bleeding was difficult to control, and the blood pressure in millimeters of mercury during the last hour averaged around 70 systolic and 50 diastolic. She was given plasma, blood transfusions and dextrose solution during and after the operation.

This case illustrates the important point that renal function will return between the eighth and the tenth day if the patient is properly treated. In this case death occurred, with gradually mounting azotemia in spite of an increasing output of urine. The pathologic diagnosis was hemoglobinuric nephrosis due to a transfusion reaction.

In the following case it was difficult to determine the amount of fluids required for balance. Whether the oliguria was due to renal damage (lower nephron nephrosis) in the remaining kidney secondary to shock, or possibly a reaction to transfusion or to dehydration, was a moot question. There was a sharp febrile reaction for seventy-two hours, and the patient exhibited the clinical signs and symptoms of dehydration.

Mr. C. K., aged 39 (Fig. 1*B*), had been injured around noon on a cold December day. A wagon wheel had passed across his abdomen, and he had lain in a field for approximately four hours. On admission, the rectal temperature was 98 F. and the blood pressure 70 systolic and 30 diastolic. He was given plasma and 1,000 cc. of whole blood. Excretory urograms revealed a good kidney on the right side, with extravasation of the contrast medium about the left kidney.

In cases of suspected renal injury it is paramount that the presence of the other kid-

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ney be demonstrated and some idea of its function established, if possible.

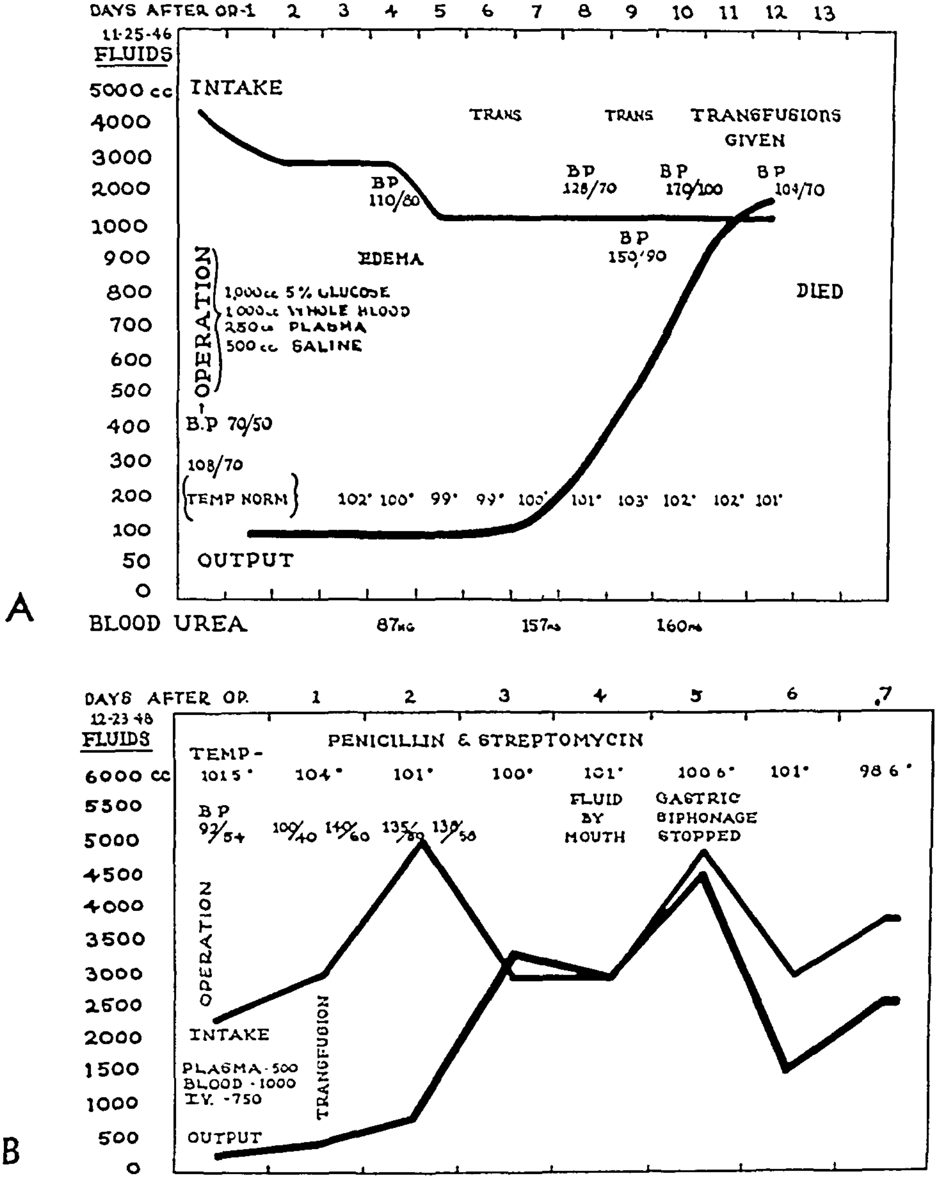

Fig. 1.—*A*, course of Mrs. C. D., aged 52. *B*, course of Mr. C. K., aged 39.

The provisional diagnosis was traumatic rupture of the left kidney and probable injury to the spleen. Traumatic rupture of the kidney with pararenal hemorrhage will simulate injury of an intra-abdominal viscus. There is usually marked abdominal rigidity on the affected side.

Abdominal exploration revealed peritonitis, tears in the serosa of the stomach, complete transverse rupture of the duodenum at the ligament of Treitz and intraperitoneal hemorrhage from the ruptured kidney. The duodenum was anastomosed and a left nephrectomy done. There was injury to the left renal vein, the repair of which, for the preservation of the kidney, may have been impossible.

This case also illustrates how complications may be masked by the use of antibiotics. Two days before his discharge the patient had a febrile reaction, the temperature being 100.2 F. On the day of discharge the temperature was 99 F. After the patient's return home a cough developed and a low-grade febrile reaction occurred. He was given penicillin therapy for

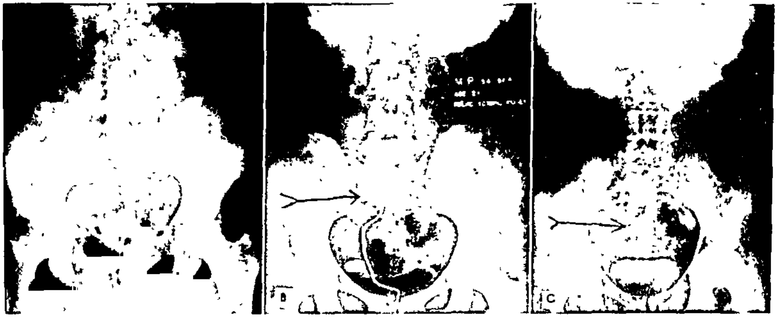

Fig. 2.—*Left*, roentgenogram of Mrs. E. R., aged 43; *center*, film taken in the case of Miss M. P., aged 23; *right*, roentgenogram of Mr. V. R., aged 29. (See text.)

approximately ten days, after which time arrangements were made for his readmission to the hospital. On that day he coughed up a large quantity of foul pus. Roentgen examination revealed signs that suggested the evacuation of a subphrenic abscess through a bronchus on the right side.

The management of anuria must vary with the individual case. The excessive use of fluids must be avoided. In the average case, in which the patient is afebrile, an intake of 1,000 to 1,500 cc. of 5 per cent dextrose in water is sufficient, or 1,000 cc. of 5 per cent dextrose in water plus the amount of the output of urine for the preceding twenty-four hours, plus any amount lost by vomiting or gastric syphonage.

In approximately 50 per cent of the cases, when the stage of diuresis occurs, recovery will follow without additional specific treatment. In the other 50 per cent death frequently occurs as a result of overtreatment. It is imperative in this stage that a proper electrolyte balance be maintained.

Traumatic rupture of the urinary bladder, which is usually secondary to fractures of the pelvis, frequently presents a clinical picture simulating injury to intra-abdominal viscera.

In those cases in which extensive injury to the veins about the vesical neck has occurred, with extensive extraperitoneal extravasation of blood, abdominal rigidity and the development of shock may be as marked (or more so) as when intraperitoneal rupture of the urinary bladder has occurred with little or no bleeding into the paravesical spaces.

Mrs. E. R., aged 43 (Fig. 2*A*), was admitted to the hospital after a motor accident. Roentgen examination disclosed fractures of all four pubic rami. A small amount of bloody urine was obtained by catheter. A roentgenogram taken after injection of an opaque medium into the bladder demonstrated paravesical extravasation. Marked generalized abdominal rigidity developed rapidly, as did severe shock. After the institution of appropriate shock therapy, immediate operation was done. The bladder was observed to be extensively lacerated, and there was profuse hemorrhage. The right obturator vessels were probably torn. The bladder was repaired and the peritoneal cavity opened. There were two lacerations through the entire thickness of the musculature of the free loop of the sigmoid, as well as extensive laceration of the peritoneum of the mesenteric root, with some bleeding.

Pelvic ectopic kidney is a common urologic anomaly. Pathologic conditions in such anomalous kidneys occur frequently; and, since the ectopia may be bilateral, the symptoms may simulate any one of most of the common abdominal lesions, especially appendicitis and f
disease. Pelvic ectopia may int
delivery, and in some in

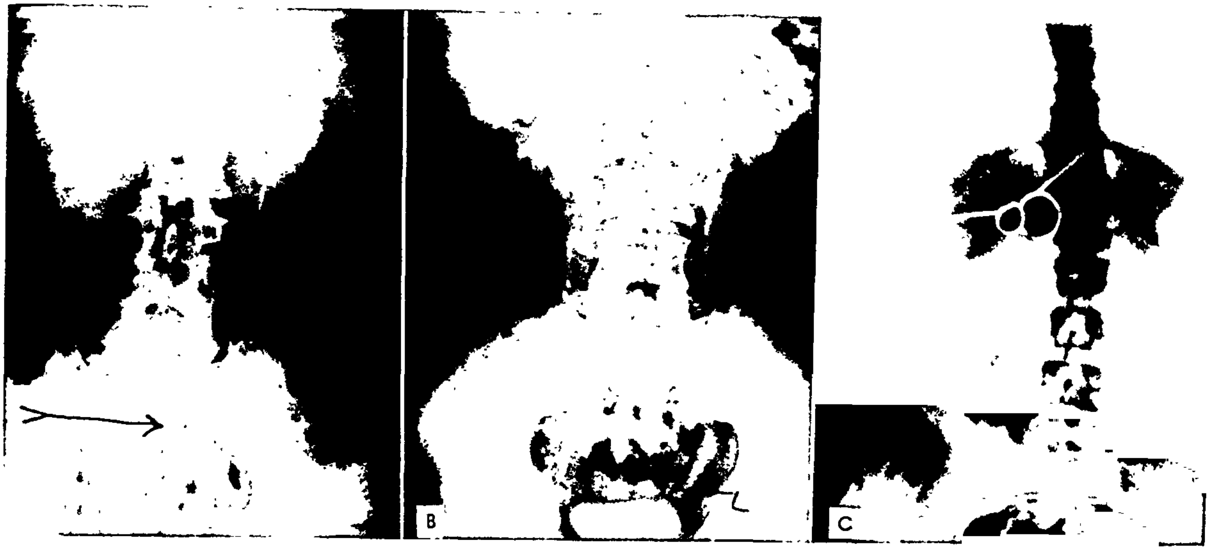

Fig. 3.—*Left*, roentgenogram of Mr. A. N., aged 45; *center*, film taken in the case of Mr. H. W., aged 29; *right*, roentgenogram of Mrs. J. M., aged 43. (See text.)

should be terminated or, if it is allowed to proceed, cesarean section should be anticipated. Fusion of the two kidneys may occur with ectopia, so that, if abdominal exploration is done and a pelvic ectopic kidney is found to be the cause of the symptoms, no operation on the ectopic kidney should be attempted until the presence or absence of another kidney has been demonstrated.

I have selected for presentation a few cases of pelvic ectopic kidneys that are of interest.

Miss M. P., aged 23 (Fig. 2*B*), suffered an attack of acute gastroenteritis. During a routine physical examination a somewhat tender mass below and to the right of the umbilicus was observed. Gastrointestinal roentgen studies revealed no abnormality. The urine was normal. Pyelographic studies demonstrated the mass to be a pelvic ectopic kidney.

Mr. W. R., aged 29 (Fig. 2*C*), complained of recurrent pain in the right lower abdominal quadrant, lasting a few seconds or minutes, with some radiation to the flank. The attacks had occurred over a period of two years. The pain became worse with activity and subsided with rest; it was worse when the bladder was full and was somewhat relieved by voiding. The urine was normal. The results of general physical examination were essentially normal. Gastrointestinal roentgen studies revealed a spastic colon. Pyelographic study revealed a pelvic ectopic kidney. The symptoms were completely relieved after appropriate therapy for the spastic bowel syndrome.

A frank attack of appendicitis with marked inflammatory changes in the appendix could produce just such a group of symptoms as those just described, with only minimal abdominal abnormalities on examination. It must be remembered, then, that if a person is known to have a pelvic ectopic kidney on the right side he may also have an attack of appendicitis.

Mr. A. N., aged 45 (Fig. 3*A*), was admitted to the hospital because of pain in the right lower quadrant of the abdomen of twenty-four hours' duration. It began as generalized low abdominal pain, later localizing to the right lower quadrant. The pain had gradually increased in severity; there was nausea, but no vomiting. Three years earlier the patient had had a similar though milder attack and had been hospitalized, with a provisional diagnosis of appendicitis. The attack rapidly subsided, and urologic consultation was requested. Pyelographic study revealed the pelvic ectopic kidney, which was considered to have been the cause of the attack.

The temperature on the last admission was 100 F.; some rigidity and exquisite tenderness were present in the right lower abdominal quadrant. The urine contained a few pus cells and an occasional red blood cell. The leukocyte count was 26,300 per cubic millimeter of blood. The surgeon's diagnosis was acute appendicitis. I was asked to see the patient and concurred in the diagnosis. The pathologic diagnosis was acute suppurative appendicitis with perforation into the mesoappendix.

Renal and ureteral calculi are known to simulate a variety of abdominal pathologic conditions. Ureteral calculi practically always produce symptoms referable to the gastrointestinal tract, chiefly intestinal gas and abdominal distention. This clinical picture is referred to as the enterorenal syndrome. In some instances the differential diagnosis between appendicitis and ureteral calculus cannot always be established.

Since appendicitis may be a lethal disease, it has always been my opinion that, if there remains a question as to diagnosis, it is much safer to remove a normal appendix.

The following case was chosen because the pain was on the left side and the internist and surgeon who first saw the patient made a provisional diagnosis of diverticulitis with perforation.

Mr. H. W., aged 29 (Fig. 3*B*), was admitted to the hospital because of abdominal pain, on the left side, of forty-eight hours' duration. The pain began in the left lower abdominal quadrant and was dull, aching and boring, gradually increasing in intensity and at times wavelike. The pain radiated to some degree into the left side of the back but chiefly into the left thigh. The patient was nauseated but did not vomit, and the bowels were loose, ten to fifteen stools having been passed on the day of onset. During the second day the pain was not so marked. The patient noted some frequency and burning on urination.

On the morning of admission the pain became so intense that he was unable to stand erect. The temperature was 96.5 F., and the skin was cold with clammy perspiration. The pulse was slow and full. Flexing of the weight of the thigh relieved the pain somewhat. Examination disclosed generalized abdominal rigidity most noticeable on the left side. The leukocyte count was 9,050 per cubic millimeter of blood, and the urine showed an occasional blood cell and a Grade 2 reaction for pus.

It is well known that small ureteral calculi will commonly produce the most severe symptoms and occasionally a rather marked picture of medical shock.

The occurrence of renal calculi and

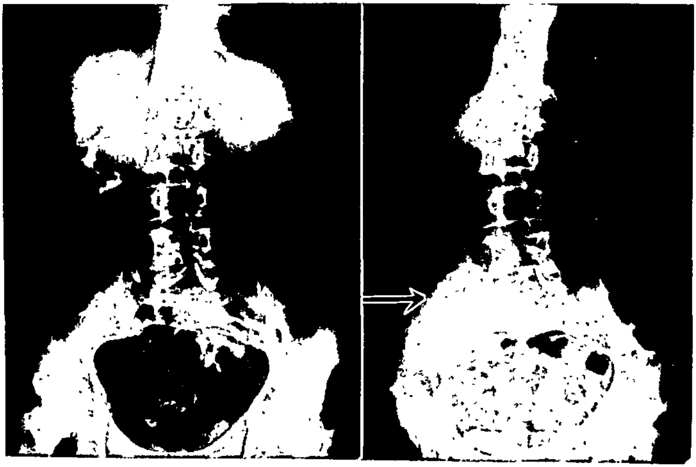

Fig. 4.—Roentgenograms taken in the case of Mr. C. R. L., aged 58. (See text.)

cholelithiasis in the same patient is fairly common. The symptoms cannot always be distinguished. Most gallstones are not radiopaque; yet only a small percentage of calculi of the urinary tract, chiefly uric acid stones, fail to show on a roentgen film.

Medical students and residents have been taught always to check a patient for a pigmented mole on the back when unusual shadows on the roentgenogram in the region of the right kidney and the gallbladder are demonstrated.

The following case is interesting because of the presence of urinary tract stone, cholelithiasis and a pigmented mole, all of which were demonstrated on the same film. The clinical history was rather confusing.

Mrs. J. M., aged 43 (Fig. 3*C*), was admitted to the hospital because of episodes of pain in the back and in the right upper quadrant of the abdomen, with nausea, vomiting, and fever. Six episodes, each lasting a week or more, had occurred during the past five months. She had lost 10 pounds (4.5 Kg.) in weight. In the first attack the pain began in the right lower abdominal quadrant and was associated with nausea and vomiting. The clinical diagnosis on admission was (1) gallbladder disease, (2) retrocecal appendix and (3) right renal disease.

A large globular pigmented mole was present on the back; the urine was infected, and the gallbladder was nonfunctioning as judged by oral cholecystographic study. Pyelograms demonstrated the urinary calculus to be in a dilated segment of the ureter. Operation disclosed the vascular pedicle supply to enter the kidney at the upper pole and posterior to the renal pelvis. An aberrant vessel crossed the ureter at the point of impaction of the calculus.

The similarity of symptoms due to chronic cholecystitis and right renal pathology cannot be overemphasized.

Mr. C. R. L., aged 58 (Fig. 4), had attacks of pain in the right lower abdominal quadrant. During the attacks there were loose stools, gas and bloating. He had been examined cystoscopically some thirty years earlier and was told that he had right hydronephrosis and that the left kidney was absent, probably congenitally. It was suggested to him that surgical treatment of the right renal condition should not be considered except as an emergency. Examination disclosed a large, freely movable right kidney. Pyelographic study revealed pyelectasis and marked ptosis in the upright film, with angulation and fixation of the ureteropelvic juncture. There were many calcific shadows in the left renal area, which suggested that the left kidney might have been destroyed by hydronephrotic atrophy. Gastric analysis showed an absence of free hydrochloric and a low content of total acids. A cholecystogram revealed a nonfunctioning gallbladder.

Exploration of the kidney was carried out. The kidney was intimately adherent to the peritoneum, especially over the duodenum. Aberrant vessels at the ureteropelvic juncture were divided, and a nephropexy was done. The gallbladder was palpated and proved to be filled with stones. It was removed. Recovery was complete.

The diagnostic problems presented by abdominal tumor masses are sometimes confusing.

Mrs. E. T. H., aged 30 (Fig. 5), six weeks before admission to the hospital noted tightness in the abdomen. Five weeks earlier she had noted a mass in the upper left abdominal quadrant, which had gradually increased in size. There was no pain and no history of previous abdominal pain. The patient's general health was good. There were no gastric symptoms. Examination disclosed a smooth, rounded mass in the upper left quadrant of the abdomen. The mass filled the flank, and it was the opinion of several physicians who examined her that it was the left kidney. Excretory urograms taken elsewhere showed a normal right pelvis and ureter. There were two renal pelves, with complete duplication of the ureters. There was deformity of the lower pelvis, suggesting either a cortical renal cyst or a tumor. Pelvic examination showed the uterus to be enlarged to about the size of a two months' pregnancy.

Exploration of the kidney was carried out, and the kidney was observed to be normal except for its size and the duplication of the pelves and ureters. The mass overlay the large kidney, and abdominal exploration disclosed a large pancreatic cyst, with very large veins in the serosal surface making its removal impossible. The cyst was anastomosed to the jejunum.

Cysts of the pancreas are not common. Several cases have been reported in which they were erroneously diagnosed as renal lesions. In this instance the presence of duplication of the renal pelves and ureters certainly added to the confusion.

*Carcinoma of the stomach* may occasionally present a bizarre clinical picture and suggest some other abdominal or renal pathologic condition. In our Clinic, when a patient presents an abdominal tumor mass and the urinary tract is considered a possible source, it is our policy to do excretory urograms or retrograde pyelograms when indicated before making gastrointestinal roentgen studies.

Mr. P. H., aged 73 (Fig. 6), came to the Clinic because of constant and sharp epigastric pain, anorexia and nausea. The pain was not influenced by eating, and there was no food intolerance. Examination disclosed a movable mass in the upper left quadrant of the abdomen. Excretory urograms and retrograde pyelograms revealed normal renal pelves. The left kidney was displaced laterally and downward, and the calices were elongated. These changes confirmed the impression of an intra-abdominal tumor mass. Gastrointestinal studies revealed an extensive carcinoma of the stomach.

As has been stated, appendicitis and pathologic conditions of the urinary tract on the right side frequently give rise to diagnostic problems. Tumors in an abdominal cryptorchid testicle are not common, and certainly the combination of tumor in an intra-abdominal testicle and acute appendicitis was somewhat confusing.

Mr. R. N., aged 46 (Fig. 7), came to the Clinic because of pain in the right lower abdominal quadrant, of twelve hours' duration. He was awakened from sleep by the pain, which was constant and did not radiate. There was some nausea but no vomiting. The urine showed a few pus cells and the leukocyte count on admission was 15,600 per cubic millimeter of blood. The temperature on admission was 100 F. There was marked tenderness in the right lower abdominal quadrant, some rigidity, and a palpable mass just above Poupart's ligament. There was a hernia type of mass and no palpable right testicle. The hernia had been present since childhood. A roentgen film of the kidneys, ureters and bladder revealed no suspicious calcific shadows and two normally placed kidney shadows. Operation disclosed an acutely diseased appendix. The mass was a seminoma of the abdominal testis. The hernial type of mass was a thick-walled hydrocele. The patient was given postoperative roentgen therapy, and there was no evidence of recurrence eight years after the operation.

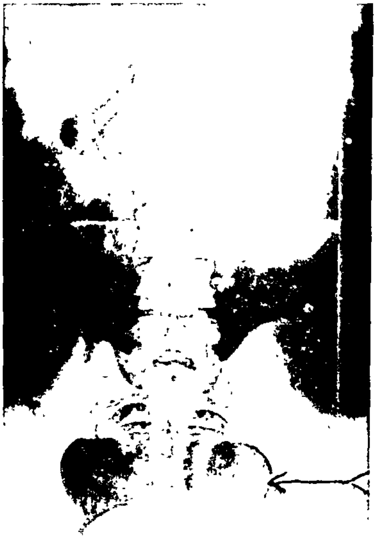

Fig. 5.—Roentgenogram of Mrs. E. T. H., aged 30. (See text.)

Accidental injury of the urinary bladder and ureters, with the development of a urinary fistula, most commonly occurs during pelvic operations in the female and frequently in operation for diseases of the left half of the colon.

During such surgical operative procedures it is paramount that the surgeon visualize both ureters. In some cases of pelvic malignant disease it is necessary for the surgeon to obtain free exposure of the terminal portions of the ureters; and, when he does so, the blood supply of the ureter may be impaired, and necrosis with subsequent fistula may develop. A generous portion of the blood supply of the terminal portion of the ureter comes from a branch of the ovarian artery.

Fig. 6.—Roentgenograms of Mr. P. H., aged 73. (See text.)

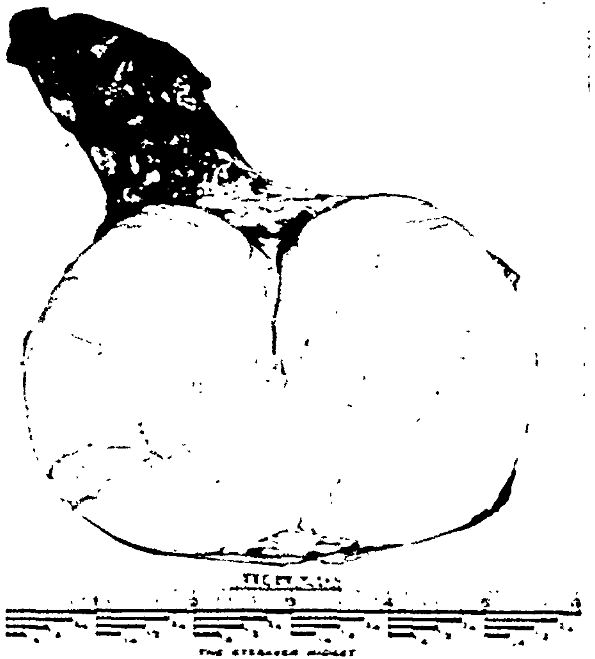

Fig. 7.—Photograph of specimen in the case of Mr. R. N., aged 46. (See text.)

In the presence of a good kidney on the other side, a nephrectomy on the affected side is conservative and is preferable to multiple operations on the ureter. The following case is representative.

Mrs. I. A., aged 62 (Fig. 8), came to the Clinic because of vaginal bleeding. The diagnosis was adenocarcinoma of the uterus. During dissection of the pelvis the terminal portion of the right ureter was freely exposed. Chills and fever occurred several days later, followed by leakage of urine from the vagina. The ureter could not be catheterized, and a fistula was demonstrated. Recovery was complete after nephrectomy. No recurrence of the uterine malignant disease had been observed six years after the operation.

Diverticulosis and diverticulitis of the sigmoid present largely a medical and surgical problem. The development of an intestinovesical fistula due to diverticulitis creates a difficult urologic problem. Diverticulitis of the bowel accounts for approximately 50 per cent of all cases of intestinovesical fistula. It is suggested that,

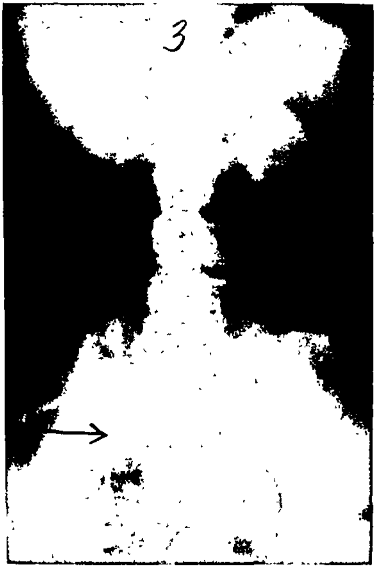

Fig. 8.—Roentgenogram of Mrs. I. A., aged 62. (See text.)

with patients with diverticulitis in whom urinary symptoms develop, consideration should be given to the possible development of an intestinovesical fistula. I have observed patients with intestinovesical fistula secondary to diverticulitis of the bowel who were admitted only because of symptoms referable to the urinary bladder. In 1 of my patients mild recurrent attacks of cystitis occurred for three years before pneumaturia developed, and there were no symptoms referable to the gastrointestinal tract. Pneumaturia, or the passage of air in the urine, is not always pathognomonic of intestinovesical fistula, but it should be so considered until it is proved to be due to some other cause.

Mr. D. B., aged 63 (Fig. 9*A*), came to the Clinic only because of frequency of urination, terminal dysuria and hematuria, of several months' duration. His history disclosed several attacks of pain in the left lower abdominal quadrant, the first attack having occurred thirty years earlier. The history of the attacks suggested an intestinal origin, probably diverticulitis. There was no history of the passage of blood from the rectum. The cystogram showed a straight line defect, as from pressure by a mass from outside the bladder. This defect I consider typical of those present in practically all cases of intestinovesical fistula. Operation disclosed a carcinoma of the sigmoid occurring in the area of diverticulosis, with marked inflammatory reaction.

The symptoms of diverticulitis may at times be extremely vague and confusing, e.g., vague lower abdominal pains and distress with a low grade febrile reaction of several weeks' duration, and the use of sulfonamides and antibiotics when the diagno-

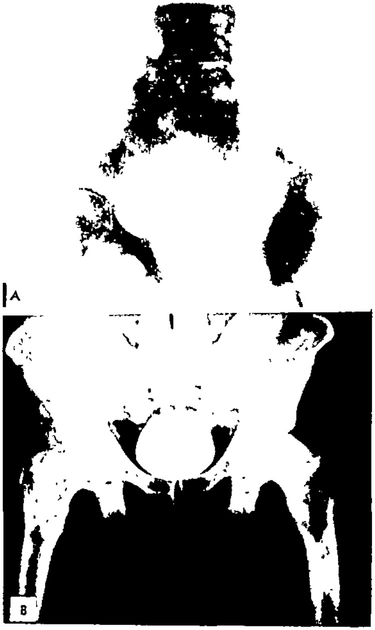

Fig. 9.—*A*, roentgenogram of Mr. D. B., aged
*B*, film taken in the case [illegible] M., aged [illegible]

sis is not clear may mask symptoms. Once the diagnosis of diverticulosis and diverticulitis has been established, the persistent use of the sulfonamides and antibiotics may be followed by a dormant abscess and the subsequent development of a fistula. For patients whose progress is not satisfactory, consideration should be given to surgical intervention.

Neither the duration, the history of symptoms referable to diverticulitis nor the severity of the attacks seems to influence the development of the fistula.

Mr. R. F. M., aged 37 (Fig. 9*B*), first noted gastrointestinal symptoms in 1948, at which time a diagnosis of diverticulosis and diverticulitis was made. He had had three episodes of diverticulitis, the last one being the most severe and prolonged, for which he was given antibiotics. Ten days or so after the onset he noted some dysuria and a few days later was quite sure he passed in the urine some mineral oil which he had been taking by mouth.

A barium enema demonstrated a large filling defect and probably a large abscess cavity. The cystogram I consider still rather typical, although a granulomatous type of lesion must be suspected, or malignant disease, even in one of his age.

In the surgical management of these cases, the importance of a preliminary colostomy established in the transverse portion of the colon to allow the inflammatory reaction to subside cannot be overemphasized. The use of the sulfonamides and the antibiotics have made it possible to do more one-stage repairs in selected cases. In spite of the use of these adjuvant drugs, the incidence of recurrence is definitely greater after a one-stage repair.

## SUMMARY

The author discusses a number of urologic conditions that may be encountered by the general surgeon: anuria from various causes; pelvic ectopic kidney; renal and ureteral calculi; disease of the gallbladder; tumor in an undescended testicle, and diverticula. Illustrative cases are included to indicate the symptoms, treatment and possible complications.

## RÉSUMÉ

L'auteur examinet una série de las conditions urologiques que le chirurgien général pouvoit encountar: anuria de las sources divers; l'éctopie pelvie del rein; les calculi rein et utérin et la maladie de la vessie.

L'étudier fait usage des éclaircissements a démonstrer les symptômes, le traitement et las complications possibles.

## ZUSAMMENFASSUNG

Der Verfasser erörtert eine Reihe urologischer Erkrankungen, denen der Allgemeinchirurg begegnen mag. Dazu gehören Harnverhaltung verschiedener Ursachen, Verlagerung der Niere ins kleine Becken, Nieren-und Harnleitersteine, Gallenblasenerkrankungen, Geschwülste im nicht herabgestiegenen Hoden und Divertikel. Die Symptomatologie, Behandlungsverfahren und vorkommende Komplikationen werden an Hand von erläuternden Fällen besprochen.

## RESUMEN

El autor discute una serie de padecimiento urológicos que pueden ser encontrados por el cirujano general: anuria de diversas causas, riñón pélvico ectópico, cálculo renal y ureteral, padecimiento vesicular, tumor en un testículo criptorquídico y divertículos. Se comunican casos ilustrativos para indicar los síntomas, tratamiento y complicaciones posibles.

## RIASSUNTO

Vengono elencate le affezioni urologiche che possono interessare il chirurgo generale: l'anuria da cause varie, l'ectopia pelvica del rene, i calcoli renali e uretrali, le malattie della vesica, i tumori dei testicoli ectopici, i diverticoli. Vengono presentati alcuni casi dimostrativi.

# Venous Cavernoma of the Fibula, So-Called "Aneurysmal Bone Cyst"

## Report of a Case

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AND
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BONE aneurysm, or "Aneurysmal bone cyst," is a relatively uncommon, usually solitary, benign multiloculated osseous tumor resembling venous cavernoma. Its dilated venous spaces are blood-filled, bordered by fibroconnective tissue and in active communication with the venous circulation.

The lesion has been most frequently observed in young and adolescent persons and arises in the shafts of the long bones, in the flat bones and in the vertebrae.[1] Recently it has been reported as occurring in the calvarium, the scapula, the sacroiliac region and the bones of the foot.[2]

The literature dealing with this subject is not very extensive, and the number of cases reported is relatively small. While it is generally agreed that the lesion is benign, confusion exists as to its origin and pathogenesis.

In 1876, Sir James Paget,[3] in his lectures on surgical pathology, stated: "In most cases described under the name Aneurism of bone or osteo-aneurism, I am far from convinced that in all cases thus entitled, the blood vessels of the bone were primarily or chiefly diseased." He stated further that many of the lesions were really "Medullary cancer or myeloid tumor of the bone."

A few authors have confused bone aneurysm, a benign lesion, with malignant disease of bone because, in many cases of the latter, there is associated hemorrhagic necrosis, as well as cystic degeneration of the bony lesion.

Malignant aneurysm of bone, as described by Geschickter and Copeland,[1] is an osteolytic sarcoma, confined at first to the medullary or cancellous portion of the bone and surrounded by bony cortex, which may subsequently become grossly cystic. As the lesion rapidly progresses and the roentgenologic picture shows alterations, the differential diagnosis becomes evident. Pathologically, there may be hemorrhage and cystic degeneration. Microscopically, the lesion is typical of malignant tumor.

De Quervain[4] published and described a case of solitary multicystic blood-containing tumor involving the entire distal third of a fibula in a boy. That case is similar to the one here reported. He called the tumor a bone aneurysm but erroneously regarded the lesion as "a form of osteitis fibrosa cystica or a giant-cell sarcoma, in which an artery had become eroded and communicating with the spaces of the tumor (*sog. aneurysma*)."

Lichtenstein,[5] in a comprehensive report, cited 8 cases in this category from various hospitals in the vicinity of Los Angeles. He made detailed histologic studies of the lesion, described its definitive pathologic picture and more aptly designated it "aneurysmal bone cyst."

His studies at that time, however, were limited to small fragments and currettings of bone from cases in which only conservative operations and biopsies had been per-

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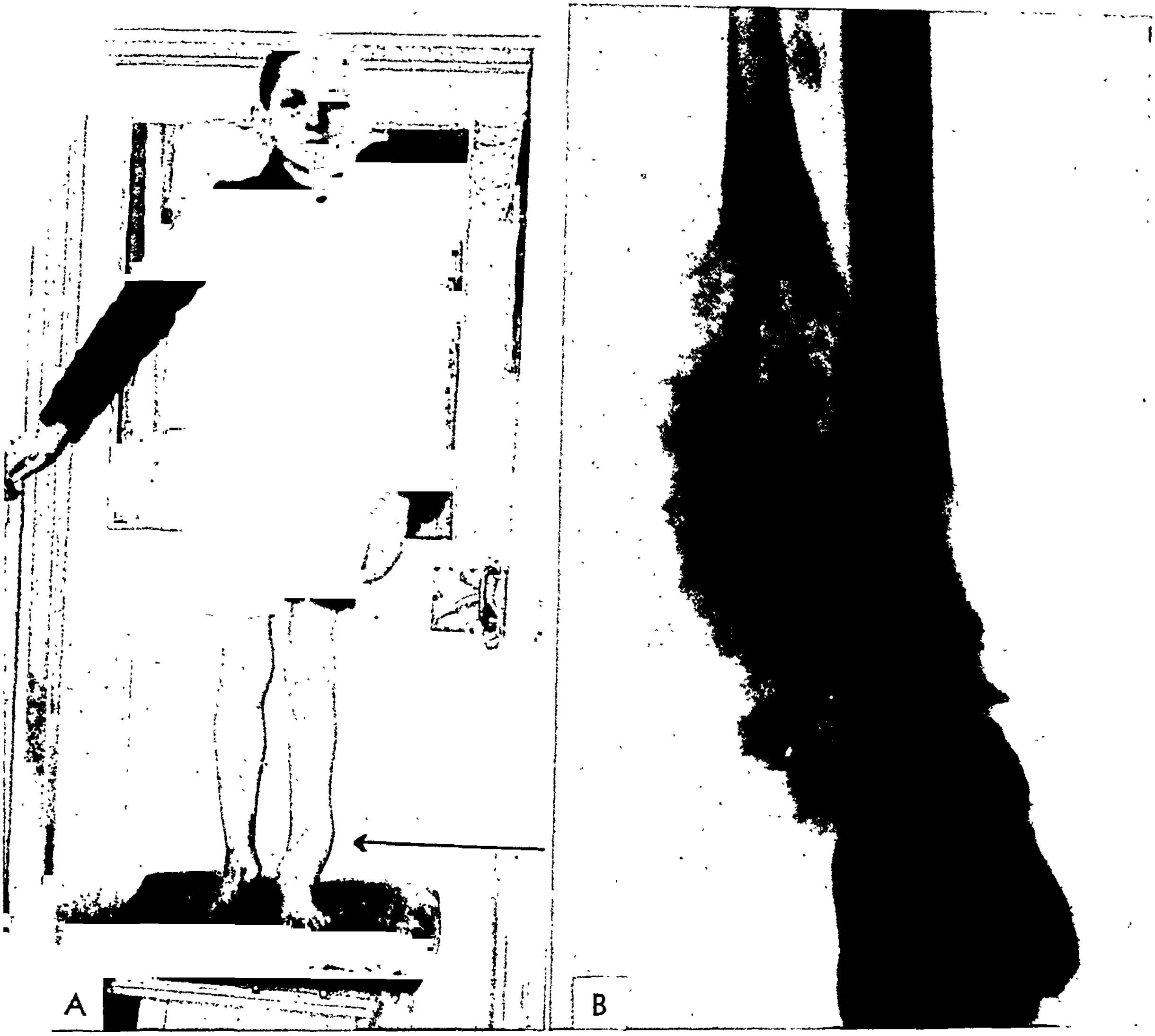

Fig. 1.—*A*, spindle-shaped tumor at distal third of left fibula. *B*, preoperative roentgenogram showing venous cavernoma involving distal third of left fibula.

formed. The lesion is benign, and he expressed doubt that it is a neoplasm at all. He acknowledged that some of the lesions were first diagnosed as giant-cell tumors, and others had been suspected of being osteogenic sarcoma.

In 1942, Jaffe and Lichtenstein[6] reported 2 cases of solitary blood-containing cyst-like lesions, classifying them at the time as aneurysmal cysts. Both occurred in male patients 17 and 18 years old respectively. In the former the lesion originated in the ascending ramus of the right pubic bone, and in the latter it involved the body of the second dorsal vertebra, with erosion of adjacent bony structures, and subsequently resulted in spinal compression.

Mayer and Kestler[7] reported a similar case in which the spine was involved at a different level, and also cited an additional case.

Pathologically, aneurysmal bone cyst, when it arises in long bones, is a localized multicystic blood-containing expanding lesion. It grows eccentrically, ballooning out the involved area and giving rise to an oval or spindle-shaped tumor formation. The cortex of the involved bone tends to be locally distended by multicystic communicating blood-filled venous spaces, which cause erosion of the involved bone, but it does not break through because of overlying reactive periostitis, with new bone deposits. Its progressive enlargement does not result from infiltration or erosion by tumor cells, but rather from increased venous pressure within the cavernous tumor.

Microscopically, the presence of multiple cyst-like blood containing dilated preformed venous channels supported by fibroconnective tissue septa are characteristic of the lesion. There may also be hemorrhage, giant cell reaction and some new bony deposits. Lichtenstein[5] contends that the presence of giant cells is the pattern of "inordinate vascularity, bone resorption and reconstruction." The pathologic significance of these giant cells may possibly be the result of bone destruction

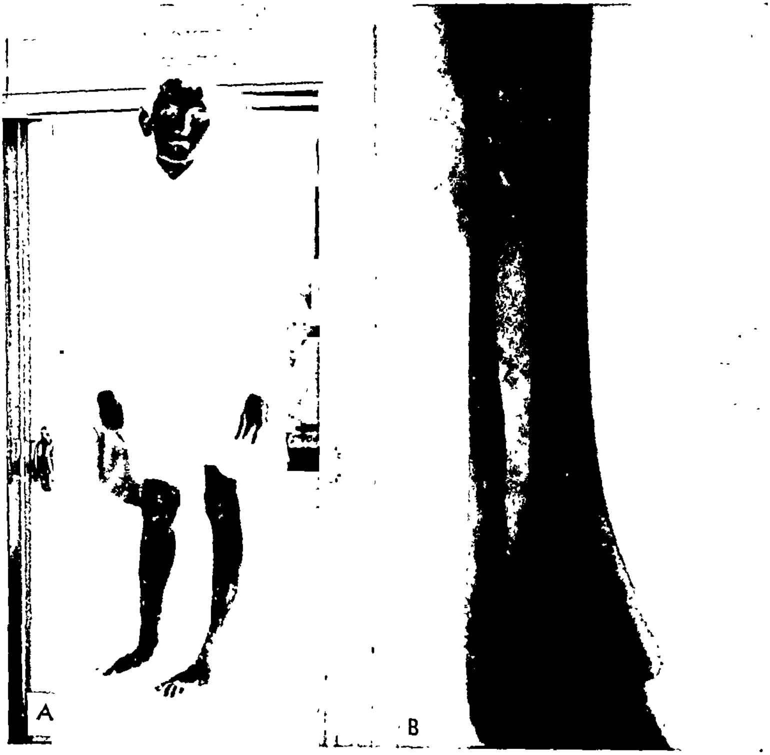

Fig. 2.—*A*, postoperative healed bone graft of distal third of fibula. *B*, postoperative result, showing photograph showing scar over distal half of left fibula.

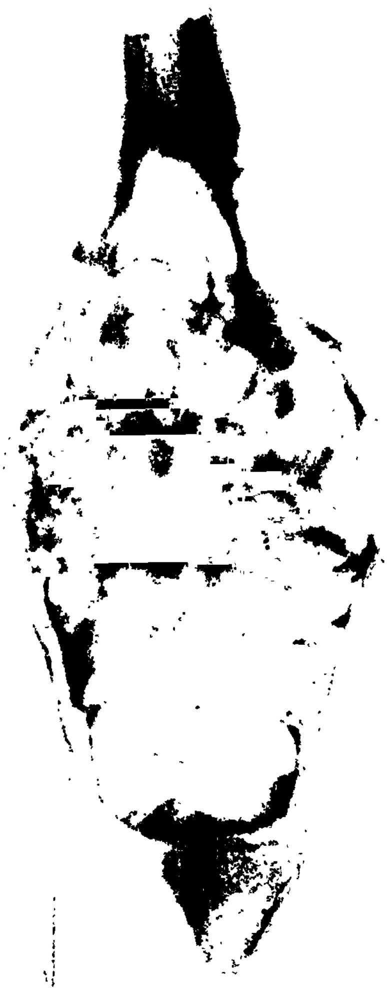

Fig. 3.—Postoperative roentgenogram of excised specimen.

and hemorrhage. It is the presence of the giant cells in aneurysmal bone cyst that causes this tumor to be mistaken for giant-cell tumor or even giant cell sarcoma.

The distention and hypertrophy of the blood spaces or multicystic blood pools in the tumor can be grossly compared with the end result of congenital polycystic disease of the kidney, in which the lesion is congenital and its multiple cysts result from hydrostatic back pressure, with secondary parenchymatous degeneration due to pressure atrophy.

In a more recent publication, Lichtenstein[2] again called attention to aneurysmal bone cyst and cited additional cases, as well as the occurrence of the lesion at other sites, such as the calvarium, the scapula, the sacroiliac region and the bone of the foot. He reiterates his previous conjecture, that aneurysmal bone cyst apparently results from a local circulatory disturbance, possibly "venous thrombosis or arteriovenous aneurysm leading to increased venous pressure and development of a dilated engorged vascular bed within the affected bone area."

Mikulicz[8] in 1906 expressed the opinion that "aneurysm of bone results from a localized derangement and growth of the involved bone."

Angioma in bone should not be confused with aneurysmal bone cyst, because the choice of treatment must necessarily be different. Typical angioma, when it does occur in bone, arises most often in the flat bones, the vertebrae, the ribs or the skull. In the long bones it may involve only the superficial cortical layer and grow outward into the surrounding soft tissues without compromising the continuity of the bone or impairing its weight-bearing function. In such cases conservative extirpation of the tumor by currettage of the bone, with implantation of bone chips, is adequate.

On the other hand, in the presence of an aneurysmal bone cyst the entire circumference of the long bone may be involved. In these circumstances, resection in the continuity of the involved bone and replacement by an autoplastic bone graft are indicated.

## REPORT OF CASE

G. H., a 14-year-old white boy, complained of a swelling involving the lower third of the left fibula.

He stated that he had felt moderate pain, especially on pressure and on motion of the ankle joint. His parents reported that the tumor had developed within one and one-half to two years. The boy was somewhat undernourished but was otherwise in good physical condition.

*Examination.*—The lower third of the left fibula was transformed into a spindle-shaped mass (Fig. 1*A*). It was the size of a large lemon; its surface was smooth and regular, and on moderate pressure parchment crackling could be elicited over different areas of the tumor, which was painful.

The first clinical impression was that of sarcoma of the fibula.

Roentgen examination (Fig. 1*B*) revealed a multicystic thin-walled tumor involving the entire bone, including the medullary cavity.

Free venous blood was obtained upon aspiration. This result and the roentgen observations led to the diagnosis. This lesion corresponds to the well-known case reported by de Quervain.[4]

*Operation.*—The lower third of the fibula was resected, with its epiphysis, and replaced by a tibial graft, with a corresponding piece of epiphysis from the right tibia. The proximal end of the graft was impacted into the medullary cavity of the proximal remnant of the fibula. Distally it was sutured to the cut ligaments of the ankle joint. A plaster cast was applied.

Healing by bony union and connection with the talocrural joint were complete six months after the operation (Fig. 2). There was no deformity or failure of growth of the bone in the ensuing years.

Ten years later the boy's parents reported that he had been inducted into the army and killed in battle.

*Pathologic Observations.*—The resected tumor occupied the lower third of the fibula, including the epiphyseal line and the malleolus, which was 15 cm. long and 9 cm. wide. It was opened sagittally and revealed large and small cavities separated by fine lamellae of fibroconnective tissue and filled with intercommunicating pools of blood. The outer shell of the bone was very thin in spots; in other areas the corticalis was thickened by bony periosteal

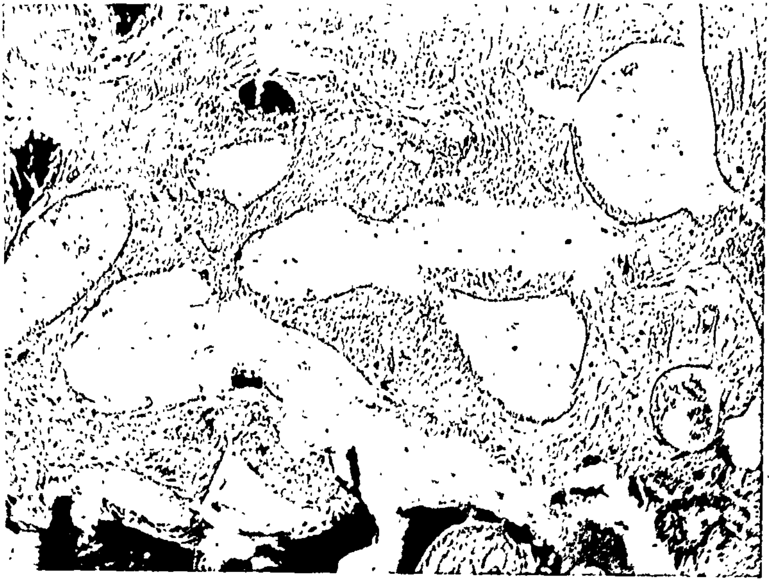

Fig. 4.—Low power view of decalcified specimen, showing multiple dilated venous
ported by fibroconnective tissue septums and numerous giant cells. Patches of ost
present.

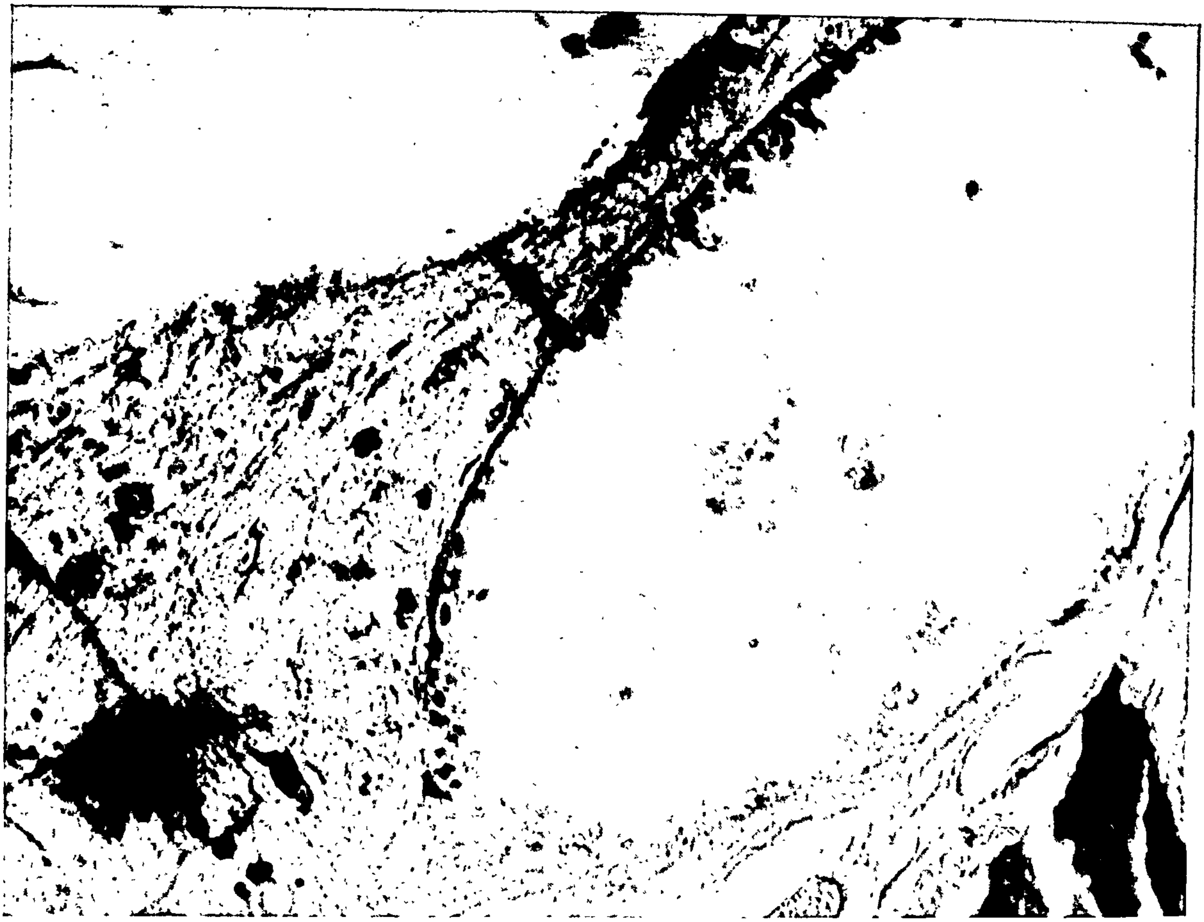

Fig. 5.—High power view of dilated venous channel lined by fibroserous tissue; contains some free blood, supported by fibroconnective tissue. Note multinuclear hemosiderin-laden giant cells, also a few patches of osteoid tissue.

reaction. This picture corresponds exactly to the roentgenogram taken of the specimen (Fig. 3).

Photomicrographs (Figs. 4 and 5) show the essential pathologic lesions as described in the legends.

We are reporting this case because of the unusual massive involvement of the entire distal third of the fibula in a boy; additionally, we wish to present a different concept as to the pathogenesis of this tumor.

It is feasible to regard aneurysmal bone cyst as a congenital venous cavernoma. Small at birth, it gradually enlarges with the growth of the involved bone. Its expansion can be explained by the increasing venous pressure within the cavernoma, which is due to stagnation of venous blood within the blood spaces, probably the result of inadequate drainage. The venous hypertension within the involved bony lesion causes pressure atrophy, necrosis and resorption of adjacent bony structure, resulting in a dilated, engorged, hypertrophied vascular bed with the consequent formation of multicystic blood-filled spaces, somewhat analogous to the venous stagnation associated with progressively enlarged varicosities.

Radical excision with replacement by bone graft is indicated when a large part of weight-bearing bone is involved. This is in contradistinction to what Lichtenstein proposed, conservative curettage. The latter procedure is applicable only to small lesions in which the bone is not compromised.

## SUMMARY

1. A case of cavernous angioma (so-called aneurysmal bone cyst) of the left fibula is reported.

2. Resection of the distal third of the fibula and three bone grafts from the opposite tibia, including a piece of epiphysis, were successfully performed.

3. In the authors' opinion this lesion has no relation to bone cyst. It is rather a congenital venous cavernoma of bone that gradually enlarges owing to increased intrinsic venous pressure.

## ZUSAMMENFASSUNG

1. Es wird äber einen Fall von kavernösem Angiom (sogenannter aneurysmatischer Knochenzyste) des linken Wadenbeins berichtet.

2. Das distale Drittel der Fibula wurde reseziert und mit Erfolg durch ein Knochentransplantat von der Tibia der anderen Seite, das ein Stück der Epiphyse einschloss, ersetzt.

3. Die Verfasser glauben nicht, dass die vorliegende Erkrankung irgendetwas mit Knochenzysten zu tun hat. Es handelt sich vielmehr um ein angeborenes venöses Knochenkavernom, das sich infolge des zunehmenden inneren Venendrucks allmählich vergrössert.

## RIASSUNTO

1. Viene riferito un caso di angioma cavernoso del perone sinistro (cosidetta cisti ossea aneurismatica).

2. Si fece una resezione del 3° distale del perone, seguita da trapianto osseo libero (dalla tibia dal lato opposto, compresa una parte di epifisi).

3. L'autore pensa che l'affezione non abbia alcun rapporto con le cisti ossee. Si tratta piuttosto di un angioma cavernoso (venoso) congenito, ad aumento progressivo dovuto alla pressione intrinseca.

## RÉSUMÉ

1. Rapport d'un cas d'angiome caverneux du péroné gauche.

2. Résection du tiers distal du péroné; greffe osseuse libre prélevée sur l'autre tibia, avec un fragment d'épiphyse. Guérison.

3. L'auteur pense que cette affection n'a pas de rapport avec le kyste osseux. Il s'agit plutôt d'un angiome veineux congénital de l'os, qui se développe graduellement en raison de l'augmentation intrinsèque de la pression veineuse.

## RESUMEN

1. Se comunica un caso de angioma cavernoso del peroné izquierdo (quiste óseo aneurismático).

2. Se llevó a cabo con exito la resección del tercio distal del peroné y el injerto óseo libre de la tibia del lado opuesto, incluyendo un pedazo de epífisis.

3. En la opinión del autor, esta lesión no tiene relación con el quiste óseo, tratándose más bien de un cavernoma venoso congénito del hueso que creoe gradulamente debido al aumento de presión venosa intrínseca.

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# Cancer of the Thyroid

## Evaluation of Results in a Recent Series

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MALIGNANT conditions of the thyroid present a challenge to the surgeon, both because clinical diagnosis is usually impossible in the earlier stages and because discriminating judgment is required in deciding upon the method of management best suited to the individual case.

By the time cancer of the thyroid can be diagnosed clinically, it is usually so far advanced that there is little hope of a satisfactory outcome of treatment. Thyroidectomy should be performed while the growth is still localized and intact. After the surrounding structures have become involved, the prognosis is not good; the more extensive the involvement, the poorer the outlook. Operation at an early stage is also the only method of guarding against metastases through the blood stream; as the thyroid, unlike other endocrine glands, is well supplied with blood vessels. Certain types of thyroid cancer are particularly likely to spread in this manner.

Another problem needing careful consideration arises when the malignancy has reached a stage at which complete removal is impossible. Experience at the DeCourcy Clinic indicates that such measures as tracheotomy and high voltage roentgen ray therapy give better results in cases of this kind than do radical operations. I have observed many patients with inoperable conditions who have lived comfortably for years under conservative treatment.

*Review of a Series of 22 Cases.*—It is the Clinic's custom to review the cases of surgical patients at intervals of a few years. Not only are its own records studied, but correspondence and personal examination of former patients, when possible, are utilized to obtain a well-rounded picture of the results of treatment. These reviews aid members of the Clinic in evaluating the methods employed and contribute to unified progress in various technics. We have recently concluded a study of a series of 851 cases of thyroid disease, classified as shown in Table 1.

TABLE 1.—*Benign and Malignant Conditions of the Thyroid*

| *Nature of Disorder* | *Number of Cases* |
|---|---|
| *Benign Conditions* | |
| Nodular goiter | 563 |
| Diffuse toxic goiter | 220 |
| Recurrent diffuse goiter | 3 |
| Thyroiditis (acute, inflammatory) | 3 |
| Hashimoto's disease | 5 |
| Riedel's struma | 15 |
| Fetal adenoma | 20 |
| Total | 829 |
| *Malignant Conditions* | |
| Cancer of the thyroid | 17 |
| Hürthle cell tumors | 5 |
| Total | 22 |
| Total for entire series | 851 |

As is shown by Table 1, the malignant growths constituted about 2.6 per cent of the series. This percentage is lower than those reported by some authors; but each of our patients received a thorough histologic examination by an excellent pathologist, and prolonged follow-up periods have provided evidence confirming the observations. The proportion of malignant tumors reported as occurring in thyroid disease varies widely. For example, McGavack[1] described a series of 408 cases, in 2.2 per cent of which the lesion proved malignant; while Crile[2] made the discovery of malignancy in 30 cases of a series of 768 thyroidectomies and stated that 5

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From the Surgical Division, DeCourcy Clinic.

inoperable thyroid cancers were diagnosed during the same period (a total of 4.5 per cent of malignancy). The incidence of cancer in the nodular goiters in this series was higher: 5.6 per cent.

Recently there have been reports in the literature of very high percentages of malignancy in nontoxic nodular goiters, especially in discrete nodules. A striking instance is afforded by the series of Cerise and his associates,[3] in which 12.8 per cent of the multinodular goiters and 19.8 per cent of the solitary nodules observed were discovered to be malignant.

Such high proportions were not present in the Clinic series; however, 10 per cent of the single nodules proved malignant. The percentage for multinodular goiters was 3.5. These percentages emphasize the importance of immediate operation, after the discovery of solitary nodules, no matter how small; and of complete removal of every nodule in cases of multinodular goiter.

As the causation of thyroid tumors is still in need of elucidation, the reasons for the variations in the reported incidence of cancer of the gland remain a matter of speculation. Several factors may be implicated. Among the most important appear to be the regional prevalence of goiter and the promptness with which patients

part. It is well established that cancer of the thyroid occurs more frequently where goiter is endemic than elsewhere;[4] and, according to McGavack[1] there is a history of preexisting adenoma or cystadenoma of one to ten years' duration in most cases of malignant goiter.

*Age and Sex Distribution.*—This series included 17 female and 5 male patients. Their ages ranged from 11 to 77 years. The age grouping is shown in the following table (Table 2).

This analysis shows that 59.1 per cent of the patients were in the sixth and seventh decades of life and that 68.2 per cent had reached or passed the age of 50.

*Diagnosis.*—Histologic study of the tumor is the deciding factor not only in reaching a definite diagnosis but in determining the prognosis in any given case. As with cancer in general, grading seems to be of great significance in the prognosis. Although Brodie's classification is not infallible, we have found it a valuable aid.

TABLE 2.—*Ages of Patients with Cancer of the Thyroid*

| *Age Group* | *Number of Cases* | *Per Cent of Series* |
|---|---|---|
| Under 30 years | 3 | 13.6 |
| From 30 to 39, incl. | 2 | 9.1 |
| From 40 to 49, incl. | 2 | 9.1 |
| From 50 to 58, incl. | 8 | 36.4 |
| From 60 to 69, incl. | 5 | 22.7 |
| 70 or older | 2 | 9.1 |

Of the 22 malignant goiters in this series, 5 were diagnosed as papilliferous carcinoma or adenocarcinoma; 1 as a mixed form of adenocarcinoma partly papilliferous; 1 as adenocarcinoma; 1 as sclerosing carcinoma; 2 as carcinoma; 1 as reticulum cell lymphosarcoma; 1 as reticulum cell lymphoma; 4 as Hürthle cell carcinoma, and 1 as Hürthle cell adenoma.

It will be noted that there were 5 patients with Hürthle cell tumors. Although medical opinion is not unanimous on the question of Hürthle cells, and their presence in nonmalignant conditions of the thyroid is not impossible, the prevailing view today supports our opinion that whenever these cells are found malignancy must be suspected and the patient treated accordingly.

*Methods of Treatment.*—The cases in this series were managed in conformity with the standard procedures at the De Courcy Clinic and the individual data on each patient.

If malignancy was discovered in an adenoma, after subtotal thyroidectomy with removal of all nodules, high voltage roentgen ray therapy over the entire neck was employed, and the patient was kept under monthly observation. If malignancy was suspected before operation for an operable growth, a bilateral total thyroidectomy was performed, with inspection of the entire neck for possible glandular involvement, followed by high voltage roentgen therapy. Our observations have led to opinion that an extremely radical operation, such as removal of the sternocleidomastoid muscle, is not advisable. I have sometimes removed the jugular vein on the affected side, but the present series included no case in which this was indicated. When malignancy has advanced so far that complete removal is impracticable, surgical intervention is considered contraindicated. High voltage roentgen therapy was administered to the inoperable patients, with the object of affording relief and prolonging life.

We have not found radioactive iodine a useful weapon against thyroid cancer. Surgical intervention is essential except when the condition is too far advanced, and high voltage roentgen therapy is the most valuable measure for inoperable cases, in general, or as an adjunct in postoperative treatment.

*Results.*—It is obvious that an adequate evaluation of the results of treatment requires prolonged observation. The patients in this series have all been followed up to 1954, or until death intervened, except 1 woman with inoperable carcinoma with whom we have been unable to maintain contact. In estimating results, we have divided the patients into three groups: (1) those now living and well; (2) those who were operated upon successfully but have subsequently died, and (3) those with inoperable conditions.

Group I (living and well) includes 10 patients. In 6 of these (60 per cent) from six to seven years have elapsed since thyroidectomy. Two patients in this group have had recurrences, which were treated promptly and responded well.

Group II includes 7 cases. The period of survival varied from two to seven years, except in 1 instance; that of a patient who refused surgical treatment until four years after her first examination and died of carcinoma of the liver six months after the operation. This case illustrates the danger of long postponement when thyroidectomy is indicated.

Most recurrences in these two groups were in the area of the gland itself, or in the larynx, the lungs or the liver.

There were 5 patients in Group III (inoperable). One patient died on the day of the first examination: 1 could not be followed; the remaining 3 lived for two months to one year under conservative treatment.

*Case Histories.*—Details of a few cases are given briefly, to illustrate certain points brought out in the preceding pages. The first 2 cases are instances of a common type of thyroid malignant disease.

CASE 1.—A woman aged 51 had papilliferous adenocarcinoma, Grade II. Operation was performed in 1948. There were two recurrences (1950 and 1951), both successfully treated. The patient is now living, with no evidence of recurrence or metastasis. Prompt treatment of recurrences has maintained the successful results of the original operation.

CASE 2.—A woman aged 77 had papilliferous carcinoma of the thyroid, Grade II. Operation was performed in 1948. The patient is living and well, without recurrence or signs of metastasis. In this instance a patient of advanced age has lived comfortably, without further trouble, for six years.

The next 2 cases exemplify less frequently encountered forms of thyroid malignant change. In 1 of these the condition was inoperable, so that prolongation of life was necessarily the chief aim of treatment.

CASE 3.—A woman aged 64 had anaplastic carcinoma of the thyroid, inoperable when first examined. Her life was prolonged for a year by roentgen ray therapy.

CASE 4.—A woman aged 27 had a hyperplastic thyroid and a Graves type malignant reticulum cell lymphoma. Operation was performed in 1948. Recurrence in 1953 was successfully treated with roentgen ray therapy. The patient is now living and well.

Results in the 5 cases of Hürthle cell tumor may be summarized as follows: 3 of the patients are now alive and well after follow-up periods of one, six and seven years respectively; 2 died of metastatic carcinoma three and five years, respectively, after thyroidectomy.

The case of a patient treated prior to the beginning of the series reported in this paper is of interest because of the many years of survival, although thyroidectomy was performed in 1939. A recurrence in 1941 was treated by surgical removal of 2 small fragments (weight 4 Gm.) overlying the thyroid cartilage. When there was a second recurrence in 1945, two small masses of tissue (7 by 12 mm.) overlying the thyroid cartilage were removed. The operations were both followed by high voltage roentgen therapy. In 1952 death occurred as a result of a laryngeal hemorrhage. Autopsy revealed a small recurrence of malignant tissue in the larynx. After the original subtotal thyroidectomy, this patient survived in comfort for thirteen years.

### CONCLUSIONS

1. Signs and symptoms of malignant disease of the thyroid seldom become manifest until surrounding structures have been invaded or metastasis through the blood stream has occurred. Hence, conditions of the thyroid in which cancer is likely to develop should receive prompt surgical treatment.
2. Every nodule, whether single or multiple, detected in the gland should be removed surgically as soon as possible after discovery.
3. The diagnosis and prognosis in each case must be based upon competent histologic study.
4. Grading appears to be an important factor in determining the prognosis.
5. In the light of present knowledge, tumors containing Hürthle cells should be suspected of malignancy.
6. Treatment of thyroid cancer depends largely upon the degree of advancement. Sound surgical judgment is represented by the following dictum: when malignancy is far advanced, operation should be limited to what is essential; when it is in an early stage, removal should be as thorough as possible.
7. High voltage roentgen ray therapy is of great value postoperatively and in cases of inoperable tumor.

### SCHLUSSFOLGERUNGEN

1. Die Symptome und klinischen Zeichen bösartiger Erkrankungen der Schilddrüse treten im allgemeinen erst auf, wenn die benachbarten Gewebe befallen sind oder Metastasen auf dem Blutwege entstehen. Aus diesem Grunde verdienen Krankheiten der Schilddrüse, die zur Krebsbildung führen können, unverzügliche chirurgische Behandlung.
2. Jeder in der Schilddrüse entdeckte Knoten, ob er einzeln oder in Gemeinschaft mit mehreren auftritt, sollte, sobald er zur Beobachtung kommt, reseziert werden.
3. Die Diagnose und Prognose des einzelnen Falles beruht auf zuverlässiger histologischer Untersuchung.
4. Klassifizierung ist offenbar ein wichtiger Faktor in der Prognosestellung.
5. Nach dem heutigen Stande unserer Kenntnisse müssen Geschwülste, die Hürthlesche Zellen enthalten, als krebsverdächtig aufgefasst werden.
6. *Die Behandlung* des Schilddrüsenkrebses hängt in hohem Grade davon ab, wie weit die Erkrankung vorgeschritten *ist. Eine vernünftige chirurgische* Beurteilung lässt sich etwa folgendermassen ausdrücken: Ist die Erkrankung weit vor*geschritten, beschränke man den chirurgi*schen Eingriff auf das Wesentliche; im frühen Stadium reseziere man so sorgfältig wie *möglich.*
7. Röntgentiefenbestrahlungen sind von grossem Wert sowohl als posoperatives *Verfahren als auch in inoperablen Fällen.*

### CONCLUSIONES

1. Los síntomas y signos de las neoplasias malignas rara vez se manifiestan hasta que las estructuras vecinas han sido invadidas, ó las metastásis hematógenas han tenido lugar. De aquí que los padecimientos tiroideos en los que se produce el cáncer deban recibir tratamiento quirúrgico inmediato.
2. Cualquier nódulo, simple ó multiple, observado en la glándula deberá ser extirpado quirúrgicamente tan pronto como sea posible después de su descubrimiento.
3. El diagnóstico y pronóstico en cada caso debe ser basado en un estudio histológico competente.
4. El grado del carcinoma parece ser un

factor importante en la determinación del pronóstico.

5. A la luz del conocimiento presente, los tumores conteniendo células de Hurtle deben ser sospechosos de malignidad.

6. El tratamiento del cáncer tiroideo depende grandemente del grado de desarrollo. El juicio quirúrgico general esta representado por la máxima siguiente: cuando la neoplasia maligna esta muy avanzada la operación debe limitarse a lo esencial; cuando esta en estadío temprano la extirpación debe ser lo más completa posible.

7. La terapia roentgen de alto voltaje es de gran valor postoperatoriamente y en los casos inoperables.

## CONCLUSOES

1. Os sinais e sintomas dos tumores alignos da tireóide raramente se manifestam até que as estruturas vizinhas tenham sido invadidas ou tenha ocorrido metastase através do fluxo sanguíneo. Portanto, quando há suspeita de câncer da tireóide, os casos devem ser submetidos ao tratamento cirúrgico imediato.

2. Todo nódulo, único ou múltiplo, encontrado na glândula, deve ser removido cirùrgicamente logo após sua descoberta.

3. O diagnóstico e o prognóstico de cada caso devemser baseados no estudo histológico competente.

4. O grau de malignidade parece ser um fator importante na determinação do prognóstico.

5. À luz dos conhecimentos atuais, os tumores que contém células de Hürthle devem ser considerados suspeitos de malignidade.

6. O tratamento do câncer da tireóide depende em grande parte do grau de adiantamento. O critério cirúrgico é representado pelo seguinte: quando há grande infiltração, a operação deve ser limitada ao essencial; quando em estado precoce, a remoção deve ser a mais completa possível.

7. A radioterapia profunda é de grande valor pós-operatório e nos casos inoperáveis.

## CONCLUSIONI

1. I segni del carcinoma tiroideo raramente divengono manifesti fino a che non si ha l'invasione dei tessuti circostanti o la comparsa di metastasi ematiche. Bisogna pertanto estirpare precocemente quelle affezioni della tiroide che possono rappresentare una condizione favorevole alla comparsa del carcinoma.

2. Bisogna asportare al più presto possibile qualunque nodulo, singolo o multiplo, che compaia nella tiroide.

3. La diagnosi e la prognosi devono essere basate su un esame istologico completo.

4. La prognosi deve essere valutata in base alla graduazione delle lesioni.

5. I tumori con cellule di Hürthle devono essere considerati maligni.

6. La cura del carcinoma della tiroide dipende dallo stadio in cui esso si trova. Quando esso è avanzato l'intervento deve essere ridotto all'essenziale, quando è precoce l'intervento deve essere il più radicale possibile.

7. Grande valore, nei casi inoperabili, acquista la roentgenterpia ad alto voltaggio.

## RÉSUMÉ

1. Les signes et symptômes des affections malignes de la thyroïde se manifestent rarement avant que les tissus environnants soient envahis ou que des métastases apparaissent par voie sanguine. De là la nécessité absolue d'un traitement chirurgical précoce.

2. Chaque adénome, qu'il y en ait un ou plusieurs devrait être immédiatement extirpé.

3. Le diagnostic et le pronostic doit être basé sur un examen histologique précis.

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Specialization is of the greatest value to surgery, not because each branch studies some small subject with greater intensity, but because each brings a fresh outlook, a new school of surgical thought, which can be applied with benefit to the rest of the art. Plastic surgery has raised the ideal of meticulous care in the handling of tissues; orthopaedic surgery stands not so much for the correction of deformity as for a vision dominated by the study of physiology and the respect of function. Such specialisms are born in the vision of some man, or group of men. They rise, like waves upon the ocean, because some driving force raises the matter around it for a time above the surrounding level; like waves, they should agitate the common body while they are moving and be taken back into its substance when the driving force is spent. Every surgeon should study the leaders of plastic surgery and return to his own work kindled with a new vision of technical perfection. The gospel of orthopaedics should animate more than the surgery of crippledom. For specialisms that remain apart tend to a dead and static perfection, having the semblance but not the reality of advance, like waves on the sand of the desert.

Fashions change, but truth is eternal, and what has been accepted by successive generations must be founded upon truth. Therefore, the main body of surgical science and thought is orthodox, and heterodoxy concerns rather the form of its expression. To quote Sir Thomas Browne: 'There is yet, after all the Decrees of Councils and the niceties of the Schools, many things untouch'd, unimagin'd, wherein the liberty of an honest reason may play and expatiate with security and far without the circle of an Heresie.'

—*Ogilvie*

# Annular Pancreas

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RECENTLY there has been a marked increase of reports on cases of annular pancreas, and a review of the literature available to me revealed 44 cases of this condition treated surgically. This review is the largest collection of surgical cases so far reported. It is summarized in the accompanying table.

The condition was first described by Tiedeman in 1818, and, since then, sporadic cases have been described. The earlier reports were all based on postmortem observations. In the past three years 28 cases, in all of which surgical treatment was employed, have been reported. The more frequent recognition of this condition is probably due to more careful gastroenterologic roentgen studies and to an increased tendency toward surgical treatment of lesions of the upper part of the intestinal tract.

*Pathologic Picture.*—The malformed pancreas affects the second part of the duodenum and occasionally the bile ducts, causing jaundice and symptoms suggestive of cholecystitis. Ravitch (1950) observed also that it may be associated with multiple deformities when it occurs in infants. McNaught and Cox (1935) stated that in infants congenital deformities may accompany this lesion in about 25 per cent of cases, but this is not borne out by the published case reports. In 1 of Ravitch's cases there was incomplete rotation of the colon; the portal vein was anterior to the duodenum, and the small bowel had an abnormal mesenteric attachment.

In many of these cases the annular pancreas was associated with gastric or duodenal ulceration. This may have been due to the gross distention of the duodenum, which caused stretching of the pylorus and upset the normal duodenal reflux into the stomach. The pathologic pancreatic observations varied from normality to chronic interstitial pancreatitis. The latter is due to the pressure of the abnormal tissue on the ampulla of Vater and reflux of bile into the pancreatic ducts.

*Embryologic Considerations.*—This aspect of the matter has been discussed by numerous authors (Baldwin in 1910, McNaught in 1933, Anderson and Whapshaw in 1951). For detailed study, reference should be made to their publications. Briefly, the pancreas develops from two outgrowths—one dorsal and one ventral—from the gut that is to become the duodenum. The dorsal outgrowth forms the tail, body and right lower quadrant of the head of the pancreas. The ventral outgrowth becomes two buds, one on each side of the common bile duct. One of these buds becomes atrophied. As the gut rotates, the ventral outgrowth migrates around the right side of the bowel and fuses with the dorsal portion to form the remaining portion of the head of the pancreas, which by further rotation comes to lie opposite the second part of the duodenum. Each outgrowth has its own main duct. In a study of these ducts, the annulus in the majority of cases of annular pancreas had a single main duct that originated in the portion of the ring overlying the left anterior surface of the duodenum.

Macrosopically the annular pancreas may present in three ways. It may have the appearance of a signet ring, which may or may not completely encircle the duodenum. When it does not completely encircle the duodenum it leaves the anterior surface of the duodenum exposed, as occurred in my own case (Fig. 1). The gland may have a normal body and tail

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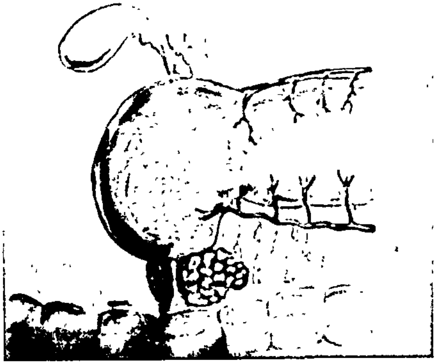

Fig. 1.—Diagram showing conditions observed at operation. Note gross dilatation of the duodenum and "signet-ring" appearance of pancreas. The anterior surface of the duodenum is uncovered by pancreas.

but may have a prolongation of the head, which passes as a slip around the duodenum. The duodenum above the constricting pancreas is usually grossly dilated and hypertrophied, and, as is well illustrated in the case here to be described, the pylorus may be grossly stretched so as to make it incompetent and even difficult to recognize. It is often observed that, after section of the annular constriction, the duodenum that was surrounded by the pancreas is markedly atresic, and that section of the pancreas does not relieve the atresia.

The ductal system in cases of annular pancreas has been extensively studied (Baldwin, 1922; McNaught and Cox, 1935; Cunningham, 1940), and these studies revealed a constant anterior point of origin of the pancreatic duct, which passes laterally and posterior to the common bile duct. This should be remembered if one contemplates sectioning the annulus.

*Symptoms.*—Annular pancreas may be entirely asymptomatic, showing no signs throughout life and only discovered at autopsy. Until recently this was the most usual means of its discovery. There is no explanation why it should cause symptoms in some cases and in others remain symptomless. There is also no known reason why this condition, which is congenital, sometimes initially manifests itself late in life.

The condition may present as a high duodenal or intestinal obstruction. In my case the patient was actually in a state of tetany due to alkalosis, which occurred as the result of persistent vomiting. The vomiting may be painless or may be associated with epigastric pain. The patient may show the classic signs of peptic ulceration, including epigastric pain after meals, and on investigation the obstruction may be detected in the barium roentgen series. The patient may present an acute abdominal emergency. One had hematemesis, and 2 (Barnes and Benedicti) acute pancreatitis. Other symptoms may simulate diseases of the biliary tract; 2 patients in this review had undergone cholecystectomy, the true condition being recognized only on reoperation. One of these patients was thought to have acute cholecystitis. A cholecystectomy was performed, but the duodenum was not inspected. The symptoms persisted, and re-exploration revealed an annular pancreas.

The outstanding symptom in the majority of cases was postprandial vomiting, usually after every meal. Symptoms are uncommon in children. It should be noted that there is no relief of symptoms when the patient lies down.

*Diagnosis.* — The diagnosis is mainly made on the basis of high intestinal obstruction and epigastric pain suggestive of peptic ulceration. If the patient is a child, the vomitus may contain bile. The diagnosis is mainly based on roentgen examination, which reveals a dilated duodenum with almost complete obstruction. The barium reveals a smooth obstruction usually in the second part of the duodenum. The roentgenogram (Fig. 2) is characteristic. If possibility of annular pancreas is borne in mind, one should be able to

*Cases of Annular Pancreas Treated Surgically*

| *No.* | *Date* | *Author* | *Age* | *Sex* | *Operation* | *Result* |
|---|---|---|---|---|---|---|
| 1 | 1905 | Vidal | 3 days | M | Gastroenterostomy | Cure |
| 2 | 1906 | Do Santos | 26 yr. | F | Gastroenterostomy | Death |
| 3 | 1908 | Lerat | 46 yr. | F | Resection of pancreatic ring | Cure |
| 4 | 1928 | Smetana | 74 yr. | M | Posterior gastroenterostomy | Death |
| 5 | 1930 | Howard | 46 yr. | F | Division of ring | Cure |
| 6 | 1930 | Brines | 35 yr. | M | (1) Drainage of pancreas<br>(2) Division of ring | Death |
| 7 | 1931 | Zetch | 27 yr. | F | (1) Division of ring<br>(2) Plastic to duodenum | Cure |
| 8 | 1931 | Brines | 44 yr. | M | Posterior gastroenterostomy | Death |
| 9 | 1940 | Truelson | 35 yr. | M | Posterior Gastroenterostomy; plastic to duodenum | Cure |
| 10 | 1942 | Lehman | 23 yr. | M | Partial resection of ring | Recovery but persistent symptoms |
| 11 | 1944 | Gross and Chisholm | 3 days | F | Duodenojejunostomy | Cure |
| 12 | 1944 | Custer and Waugh | 72 yr. | M | Gastric resection and anterior gastroenterostomy | Cure |
| 13 | 1946 | Goldyne and Carlson | 26 yr. | M | Resection of ring | Cure |
| 14 | 1946 | Nedelec | 17 yr. | M | Posterior gastroenterostomy | Cure |
| 15 | 1948 | Brown, Bingham and Cronk | 53 yr. | F | Resection | Death |
| 16 | 1949 | Burger and Alrich | 4 days | F | Resection and duodenoplasty | Death |
| 17 | 1950 | Baker and Wilhelm | 59 yr. | M | Gastroenterostomy and duodenojejunostomy | Cure |
| 18 | 1950 | Bickham and Williamson | 25 yr. | M | Posterior gastroenterostomy | Cure |
| 19 | 1950 | Dubost, Alary and Sullivan | | | Details not available | |
| 20 | 1950 | Haden | 3½ yr. | M | Removal of band of pancreas | Cure |
| 21 | 1950 | Ravitch and Woods | Newborn | F | Duodenojejunostomy | Cure |
| 22 | | Ravitch and Woods | Newborn | M | Gastroenterostomy | Cure |
| 23 | | Ravitch and Woods | 67 yr. | M | Removal of portion of pancreas and duodenojejunostomy | Cure |
| 24 | 1950 | Ohlmaker and Marshall | 27 yr. | M | Partial gastrectomy and posterior gastroenterostomy | Cure |
| 25 | 1950 | Orts and Duenas | | | Details not available | |
| 26 | 1951 | Anderson and Wapshaw | 32 yr. | F | Resection of ring; drainage of common bile duct | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 27 | 1951 | Cattell | Adult | M | Division of ring and later partial gastrectomy | Cure |
| 28 | 1951 | Conroy and Woelfel | 30 yr. | M | Resection of portion of pancreas | Cure |
| 29 | 1951 | Conroy and Woelfel | 28 yr. | F | Gastroenterostomy | Cure |
| 30 | 1951 | Payne | 33 yr. | M | Partial resection of ring, persistent duodenal obstruction | Cure |
| 31 | 1951 | Wakeley | 36 yr. | M | Division of pancreatic ring | Cure |
| 32 | 1952 | Gonzales, Lopez and Paz | 25 yr. | F | (1) Cholecystectomy<br>(2) Sectioning of pancreatic ring | Cure |
| 33 | 1952 | Shapiro and Dzwick | Newborn | F | Gastrojejunostomy | Cure |
| 34 | 1952 | Gerrish | Newborn | F | Duodenojejunostomy | Death |
| 35 | 1952 | Gerrish | Newborn | M | Duodenojejunostomy | Cure |
| 36 | 1952 | Gerrish | Newborn | F | Duodenojejunostomy | Cure |
| 37 | 1952 | Silvis | 32 yr. | M | Partial resection of pancreatic ring | Cure |
| 38 | 1952 | Borrill and Bailey | | | Details not available | |
| 39 | 1953 | McPhee | 26 yr. | M | Separation of pancreatic ring | Cure |
| 40 | 1953 | Swynnerton and Tanner | 30 yr. | M | Vagotomy and pyloroplasty | Cure |
| 41 | 1953 | Wilson and Bushart | 18 days | M | Posterior gastroenterostomy | Cure |
| 42 | 1953 | Wilson and Bushart | 20 months | M | Duodenojejunostomy | Cure |
| 43 | 1953 | Wilson and Bushart | 5 days | M | Duodenojejunostomy | Death |
| 44 | 1953 | Skapinker | 22 yr. | F | Duodenojejunostomy | Cure |
| 45 | 1953 | Tomsykoski, Stevens and Izzo | 50 yr. | F | Division of ring;<br>partial gastrectomy;<br>fistula roux exclusion | Cure |

the condition preoperatively; I was able to do so in the case to be reported. Failure to diagnose is usually failure to consider the condition. In only a few of the cases reviewed was the diagnosis made preoperatively.

Another interesting feature was that, in 5 in which exploratory laparotomy was done, the annular pancreas was missed at the first operation. The conditions that must be considered in the differential diagnosis are duodenal ileus, polyp or diverticulum of the duodenum, and malignant tumor. Duodenal ileus usually affects the third part of the duodenum and is usually relieved by placing the patient in the knee-elbow position for a short time. This procedure may occasionally give relief in a case of annular pancreas, as it did in 1 case described by Conroy and Woelfel.

In children it may be difficult to differentiate this condition from pyloric stenosis or duodenal atresia; it is noteworthy that in the great majority of cases reviewed it occurred in the fi[illegible]e [illegible] life. The vomitus usually co[illegible] it

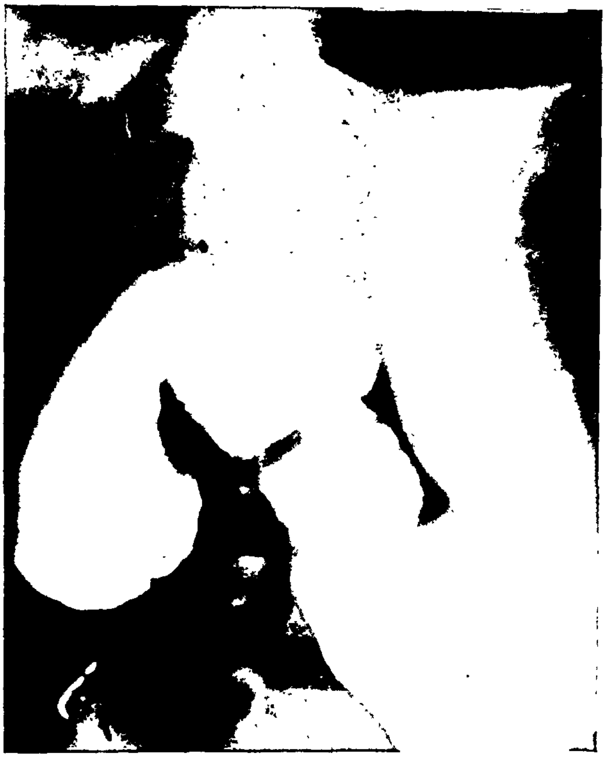

Fig. 2.—Typical arrest of barium in second part of duodenum.

did in 7 out of 9 cases in which this fact was recorded. This may aid in making a diagnosis. Three of the babies were jaundiced. Another 2 showed associated congenital defects. One of Ravitch's patients had incomplete rotation of the colon, and the portal vein was anterior to the duodenum and had an unattached small bowel mesentery. In the second patient (Shapiro, Dzwick and Gerrish, 1952) there was incomplete rotation of the colon and mongolism. Another patient, described by Shapiro and his co-workers, had mongolism.

*Treatment.*—This falls into two main categories, namely severance of the ring of the annular pancreas and bypass operations. In the first there is always the danger that in sectioning the pancreas one may damage the duct and cause a pancreatic fistula and its sequelae. In 3 of the recorded cases this complication occurred, and in another a pancreatic cyst developed. The actual duodenum is often stenosed, and simple division of the annulus is not sufficient to relieve the obstruction. In such cases a plastic duodenal operation must be done in addition.

The second attack is a bypass operation (gastroenterostomy and duodenojejunostomy) and these have been found more satisfactory and less likely to cause complications. In 2 patients who had previously undergone section of the annulus, short-circuiting procedures were necessary. In my opinion, the most satisfactory operation is a retrocolic duodenojejunostomy. The first part of the duodenum is hypertrophied and dilated; it mobilizes easily and can be anastomosed to the jejunum without any danger of stomal ulceration. In the case to be reported here it was noticed that, even after the duodenojejunostomy stoma was functioning satisfactorily, the duodenum remained dilated for a considerable time. In the majority of the recorded cases in which bypass operations were performed, a gastroenterostomy was done. In 3 cases (Custer and Waugh, 1944; Ohlmake and Marshall, 1950; Cattell, 1953) a partial gastrectomy was done because of associated peptic ulceration or other complications, with good results.

*Mortality Rate.*—There has been a rapid decline of the mortality rate in the more recently reported cases, owing to antibiotics, improvement in surgical technic and improved anesthesia. The only recorded deaths in the last 25 cases described since 1950 occurred in 2 newborn infants.

## REPORT OF CASE

E. S., an unmarried Bantu woman aged 22, was admitted to Baragwanath Hospital on March 11, 1953, with a diagnosis of vomiting and tetanic spasms. The history dated back to September 1952, when she was admitted to this hospital for an incomplete abortion. She stated that after discharge from hospital she started to vomit and lose weight. This "settled down" until January 1953, when the vomiting recommenced. Nausea always preceded the vomiting, and the attacks always came on after meals. Nothing relieved them. Occasionally she regurgitated food that was stained with bile. She noted that she was able to retain fluids better than solids.

A day before admission she began to have generalized cramps. Examination revealed her to be emaciated. The blood pressure in millimeters of mercury was 100 systolic and 20 diastolic. Dehydration and obvious loss of weight were observed. Chvostek's sign was positive, and the patient readily exhibited spasm of the arm on application of a Baumanometer cuff. Succussion splash was easily elicited, and the stomach was greatly distended to palpation.

Dextrose-saline solution, 2,000 cc., was immediately given intravenously, and on the next day (March 13) the value for serum potassium was 8 mg. per hundred milliliters (= 2.1 milliequivalents per liter. Regular intravenous replacement therapy was continued for one week. Roentgenograms were taken on March 18, and the characteristic pattern was presented (Fig. 2). Retention was marked, and there was very little emptying of the stomach even after seven hours (Fig. 3*B*). The diagnosis of annular pancreas was made, and it was decided to prepare the patient for operative treatment.

With the patient under general anesthesia, operation was performed on March 25. The abdomen was entered through a transverse upper abdominal incision. There was marked wasting of the subcutaneous fat. The duodenum was mobilized and was observed to be greatly dilated and hypertrophied, measuring 9 cm. across. The pylorus was greatly stretched and could be distinguished only by palpation and by identifying the pyloric vein. The cause of the obstruction was an annular pancreas of the signet ring variety (Fig. 1), almost completely surrounding the second part of the duodenum, leaving only a margin of 0.5 cm. of duodenum free. No other pancreatic tissue could be palpated, and none extended across the midline. A retrocolic duodenojejunostomy was performed.

The patient made an uneventful recovery and was followed up for six months.

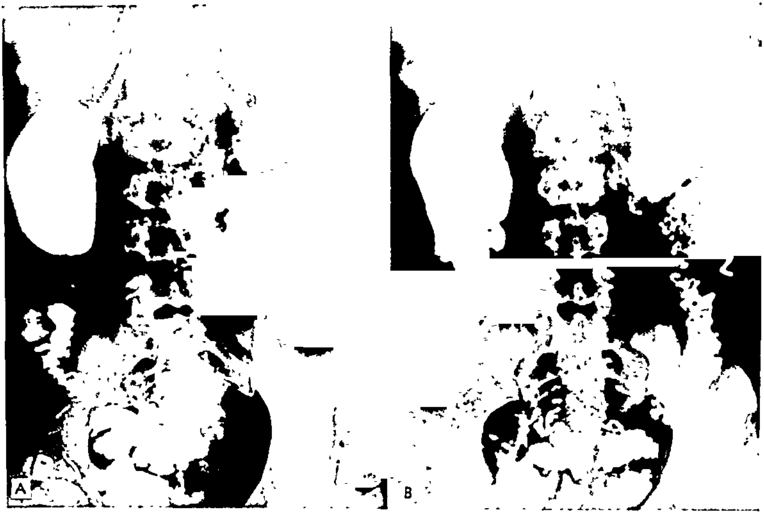

Fig. 3.—*A*, follow-up film three hours after barium meal. Area of arrest is smooth and rounded. Very little barium has passed into small bowel. *B*, film taken seven hours after commencement of meal; marked retention still present.

## SUMMARY

A review of 44 cases of annular pancreas, treated surgically, is presented in tabular form.

The embryologic, anatomic and symptomatic aspects of this condition are discussed.

Methods of treatment are given, and duodenojejunostomy is advocated.

A case is reported. An additional case has been observed since this paper was completed.

*Author's Note*: I wish to thank Mr. C. D. Kisner, M.Ch., for the diagram presented in illustration of this article.

## ZUSAMMENFASSUNG

44 Fälle von chirurgisch behandeltem annulärem Pankreas werden in Tabellenform dargestellt. Die Erkrankung wird von embryologischen, anatomischen und symptomatischen Gesichtspunkten aus erörtert.

Behandlungsmethoden werden angegeben, und die Duodenojejunostomie wird empfohlen.

Ein Fall wird beschrieben. Ein weiterer kam nach Abschluss dieser Arbeit zur Beobachtung.

## RESUMEN

Se presenta en forma tabular una revisión de 44 casos de páncreas anular.

Se discuten los aspectos embriológicos, anatómicos y sintomáticos de este padecimiento.

Se dan los metodos de tratamiento y se preconiza la duodenoyeyunostomía.

Se comunica un caso. Después de haberse terminado el artículo se observó un caso adicional.

## RIASSUNTO

Sono stati raccolti e tabulati 44 casi di pancreas anulare curati chirurgicamente. Di questa affezione viene fatto un quadro embriologico, anatomico e sintomatologico; fra i metodi di cura si consiglia la duodeno-digiunostomia. Presentazione id 2 osservazioni.

## RESUMO

Uma revisão de 44 casos de pâncreas anular, tratados cirùrgicamente é apresentada em quadro.

Os aspectos embriológico, anatômico e sintomático desta afecção são discutidos. Métodos de tratamento são apresentados e, a duodenojejunostomia é defendida. É comunicado um caso. Uma observação adicional foi vista depois de completado êste trabalho.

## RÉSUMÉ

L'auteur présente sous forme de tableaux une revue de 44 cas de pancréas annulaire traités chirurgicalement. Les aspects embryologiques, anatomiques et symptomatiques de cet état sont discutés. L'auteur donne les méthodes de traitement en montrant l'intérêt de la duodéno-jéjunostomie. Il en expose un cas et en a observé un autre encore depuis qu'il a écrit cet article.

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Speaking generally, were society not an artificial structure, every simple and genuine feeling would not produce the great effect it does; it would give pleasure without surprise, but, as a matter of fact, it both surprises and pleases. Our surprise is a satire on society, our pleasure an act of homage to nature.

Nature seems to make use of men for the accomplishment of her designs without concerning herself about her instruments, like tyrants who rid themselves of those who have been of service to them.

Men's ideas are like cards and other games. Ideas which I remember to have seen regarded as dangerous and over-bold have since become commonplace and almost trite, and have descended to men little worthy of them. So it is that some of the ideas which to-day we call audacious will be considered feeble and conventional by our descendants.

—*Chamfort*

# Total Colectomy

## Indications and End Results

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PHYSIOLOGISTS mention various functions of the colon. From a surgical standpoint, however, the interpretation of symptoms is much simplified if one considers only two main functions, namely (1) water absorption and (2) elimination of waste products.

Contents enter the colon as liquid and leave it in solid form, so fluid must be absorbed during transit. Any irritative lesion will stimulate peristalsis and there will be fluid loss (diarrhea).

Obstructive lesions of the cecum, in contrast with those of the left half of the colon, occur late, owing to fluid content of the organ.

Secondary anemia from cecal carcinoma is due, probably, not to excessive hemorrhage but to a longer period of hemorrhage, as obstructive symptoms come on later. Therefore the simple function of water absorption looms large in physiologic and pathologic considerations with regard to the colon.

The second function, elimination of waste products, however necessary, is secondary, and the consistency of the contents on evacuation depends on the exit. In other words, from a cecostomy the contents will be liquid; from a transverse colostomy, semisolid, and from a sigmoid colostomy, solid.

After total colectomy these functions, which are necessary to life, can be and are taken over by the small bowel, chiefly the ileum. At first there is intense dehydration and salt depletion, but these can be corrected parenterally and the body metabolism will adjust itself, usually within a period of two weeks.

*Indications for Total Colectomy.*—The indications are (1) multiple polyposis and (2) intractable ulcerative colitis.

1. *Multiple Polyposis:* This is a familial disease, affecting families in every large city. It occurs chiefly in boys and men from 10 to 40 years of age. Children are rarely affected. Apparently they inherit the tendency to the disease rather than the disease itself. Embrylogically it appears as a mendelian dominant characteristic. There may be no symptoms, in which case the disease is discovered on routine examination. The polyps are both sessile and pedunculated and appear in great numbers—as many as 800 in one case. They are present in all parts of the colon, including the rectum. Diagnosis is made by sigmoidoscopic examination and the double contrast barium enema.

It is a generally accepted theory that colonic carcinoma develops in a polyp, so that the potentiality for malignant change in these cases is very great. In one local family that I was able to trace, the patient, a man aged 32, was the only survivor. His mother, two aunts and a brother had succumbed to cancer. This disease is evidence of a heredity factor in the causation of malignant disease.

Total colectomy is definitely indicated in all such cases. An ileorectoscopic procedure, with fulguration of the growths in the rectum, is the method of choice. Gabriel pointed out that the greatest cancer-producing area is left, i.e., the rectum, but it can be watched and recurring growths fulgurated repeatedly if necessary. The patients are young and should

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not be left with a permanent ileostomy unless absolutely necessary.

2. *Ulcerative Colitis:* In the majority of cases ulcerative colitis can be treated medically, but as the cause is not known there is no satisfactory cure. Regardless of the primary cause, secondary infection plays a large role. This secondary infection responds to the antibiotics, but there are inevitable recurrences.

Fleming's enzyme "lysozyme" promised some hope as a causative factor, but recent experiments do not confirm this. Gray produced a prompt fall in lysozyme by oral administration of an inhibitor "aerosal" but failed to change the course of the disease or effect remission.

There is a small percentage that does not respond to any medical treatment, there are no remissions; the patient steadily deteriorates, and serious complications develop, such as arthritic changes and sinus formation. I should like to report one complication I have encountered which I have not heard mentioned before, namely, cirrhosis of the liver. This occurred in a young woman, aged 19, with extensive colonic involvement, for which a total colectomy was performed. It was due probably to septic absorption from the bowel or to avitaminosis.

These intractable conditions should be treated by a total colectomy. The postoperative response is rapid; fever subsides, appetite improves, there is a marked gain in weight and the patient is at least partially rehabilitated. He is left with a permanent ileostomy, but this can be handled with an ileostomy bag—the Rutger's type is satisfactory.

B. N. Brooke listed the following indications for total colectomy:

1. No remissions; not responding to treatment
2. Stricture; fistula; arthritis
3. Danger of carcinoma

He also suggested as contraindications (1) acute fulmination and (2) involvement of the ileum.

*Operative Procedure.*—Adequate preparation of the patient with antibiotics and sulfa drugs is important. One recent antibiotic, Neomycin given orally or injected into the bowel at operation, is claimed to have a marked effect in reducing pathogenic bacteria. Potassium deficiency should be investigated and corrected.

Patients with polyposis are usually in good physical condition, with no inflammatory reaction of the bowel and no adhesions. They will tolerate an ileorectoscopic procedure and total colectomy at one session.

Patients with ulcerative colitis are poor risks. They are anemic, dehydrated and underweight, and they have infected intestines, with adhesions and foreshortening of the mesentery. Usually the operation must be done in stages. Ileostomy alone puts the bowel at rest but does not remove the septic focus. Frequently it is the only procedure the patient will tolerate. The colectomy is performed at a later date and is finally followed by resection of the rectum.

Ileostomies frequently prolapse, and the ileum should be plicated and attached to the peritoneum for at least 6 inches (15 cm.) to prevent this.

Reperitonization of the denuded area after total colectomy is impossible. Any attempt at repair will leave recesses and bands and will cause future trouble, such as internal hernia.

Total colectomy is just just two hemicolectomies and can be performed by any surgeon. In my opinion this operation should be done in all cases of multiple polyposis and in a greater number of cases of ulcerative colitis.

## SUMMARY

The indications for total colectomy and the results of this operation are discussed. The interpretation of symptoms is based on the two main functions of the colon, namely, the absorption of water and the elimination of waste products. The author states that total colectomy is indicated in cases of multiple polyposis and of intractable ulcerative colitis, and cites from other authors the additi[illegible] ind[illegible]ions, stricture, fistula and [illegible]

### RÉSUMÉ

Etude des indications de la colectomie totale et de ses résultats. L'interprétation des symptômes est basée sur deux fonctions principales du colon: absorption de l'eau et élimination des produits de déchets. L'auteur affirme que la colectomie totale est indiquée dans les cas de polypose multiple et de colite ulcéreuse, dont la thérapeutique médicale a échoué. L'auteur ajoute encore les indications suivantes: rétrécissement, fistule, et carcinoma éventuel.

### ZUSAMMENFASSUNG

Die Indikationen für die totale Dickdarmresektion und die Erfolge der Operation werden erörtert. Die Deutung der Symptome beruht auf den beiden Hauptfunktionen des Dickdarms, nämlich der Absorbierung von Wasser und der Ausscheidung von Abfallstoffen. Der Verfasser hält die totale Dickdarmresektion für indiziert in Fällen von multipler Polypose und von unbeeinflussbarer geschwüriger Dickdarmentzündung. Als weitere Indikationen führt er nach anderen Quellen Strikturen, Fisteln und Karzinomverdacht an.

### RESUMEN

Se discuten las indicaciones para la colectomía total y los resultados de esta operación. La interpretación de los síntomas se basa en las dos funciones principales del colon, la absorción de agua y la eliminación de productos de desecho. El autor establece que la colectomía total está indicada en los casos de poliposis múltiple y de colitis ulcerativa rebelde, citando de otros autores las indicaciones accesorias siguientes: estrechez, fístula y posiblemente carcinoma.

### RIASSUNTO

Vengono discusse le indicazioni e i risultati della colectomia totale. Le funzioni del collo sono fondamentalmente due: il riassorbimento dell'acqua e l'eliminazione dei prodotti di rifiuto. L'autore afferma che la colectomia totale trova la sua indicazione nei casi di poliposi diffusa, di colite ulcerosa ribelle, di stenosi, di fistola ed eventualmente anche di carcinoma.

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Aristotle could have avoided the mistake of thinking that women have fewer teeth than men, by the simple device of asking Mrs. Aristotle to keep her mouth open while he counted. He did not do so because he thought he knew. Thinking that you know when in fact you don't is a fatal mistake, to which we are all prone. I believe myself that hedgehogs eat black beetles, because I have been told that they do: but if I were writing a book on the habits of hedgehogs, I should not commit myself until I had seen one enjoying this unappetizing diet.

—*Russell*

# Carcinoma in Situ

## What Is the Practical Therapy?

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Since the strivings of Semmelweis, medical science has been looking to the day when medicine would become a [illegible] preventive science. This has reached a long way up to this twentieth century and has gradually, one step at a time, sometimes slow and sometimes faster, [illegible]ed the time lapse between the beginning of a disease process, with its diagnosis, and the treatment thereof, with its prognosis. With modern drugs and antibiotics, one no longer thinks of the pneumonias in terms of "crisis and lysis." Also, the days of vitamin deficiencies are fast nearing extinction with the prophylactic addition of vitamins to every type of foodstuff processed today.

In this era, when life expectancy has been increased approximately fifteen years in half a century, it is to be expected that the diseases of elderly women will become more prevalent. These conditions, for the most part, are in the realm of neoplasia, and, as the prognosis is always disheartening, the challenge which we must accept is to diligently persist and to discover malignant processes as soon as possible after they begin.

Carcinoma *in situ* has a ray of hope in handling of cancer of the cervix. This process was first named by Schauenstein in 1907 and in 1932 by Broders, and in 1926 Schiller conceived the idea that true cervical cancer might begin as a superficial lesion and remain within the epithelium for a considerable time before becoming an invasive process.

*Incidence.*—Numerous investigations by Pund,[1] Smith and Pemberton, Scheffey, Jones, Galvin and TeLinde[2] and others have been recorded. Pund, with a series of 1,200 surgically removed cervices studied by serial section, reported an incidence of 47 cases (3.9 per cent) of preinvasive carcinoma. Earlier, Schiller had reported an incidence of 3 per cent in his series. Younge reported that in a series[3] in which he used routine cervical biopsies there was an incidence of 1.2 per cent of positive diagnoses.

Using the smear technic alone for screening, Kaufman and his co-workers[3] reported an incidence of 0.44 per cent of positive diagnoses, while Dahlin and his collaborators[4] reported an incidence of 0.73 per cent. All of the aforementioned surveys were made with a total of 10,000 or more smears. Achenbach[5] reported an incidence of 0.42 per cent, usi[illegible] technic [illegible]

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cidence of positive diagnoses by the smear technic alone vividly depicts the great aid that is afforded positive diagnosis by having a portion of os tissue instead of only a smear for diagnosis.

*Age.*—Herein is one of the factors that give carcinoma *in situ* such value in the prognosis after cervical cancer has been diagnosed. Table 1 indicates the source of the work, the number of cases diagnosed (when this was available) and the average age of the patient at the time of diagnosis.

TABLE 1.—*Age Incidence*

| *Authors* | *Number of Cases* | *Age at Diagnosis Years* |
|---|---|---|
| Pund et al.[1b] | 47 | 36.6 |
| Achenbach et al.[5] | 60 | 35.2 |
| Achenbach et al. (previous series) | 135 | 38 |
| Dahlin et al.[6] | 73 | 42.1 |
| Jones, Galvin and TeLinde[2] | 75 | 37.1 |
| McManus and Findley[7] | 8 | 35 |
| Douglas et al.[8] | 14 | 37.3 |
| Douglas[8, 9] and McManus[7] | 22 | 36.5 |

(Medical College of Alabama combined.)

The average age of patients in whose cases invasive carcinoma was diagnosed was 48 years. Considering the average age of the patients in various series of carcinoma *in situ*, it is quite evident that carcinoma *in situ*, has an appreciable latent period, during which it is limited to the epithelial covering of the cervix. It is this latent period that provides the opportunity to practice wholesome preventive medicine by astute diagnosis. By virtue of it, one must presume that carcinoma *in situ* exists for ten to twelve years before it becomes invasive or clinically apparent. At first consideration this seems a long time, but for many women 35 to 45 years old who have no clinical symptoms this time would cover only two or three visits to the gynecologist. For that reason it would naturally seem incredible that any invasive cervical cancer could develop in the presence of "regular" pelvic examinations and in the absence of clinical symptoms. The question whether carcinoma *in situ* is truly a precursor of squamous cell carcinoma of the cervix is still raised. We shall consider this presently.

*Pathologic Nature of Carcinoma in Situ.*—Robert Meyer propounded three postulates as prerequistes in the diagnosis of carcinoma:

1. An atypical architectural pattern, with loss of normal stratification due to rapid multiplication of cells.
2. Anaplasia of cells, with great disparity in size and maturity thereof.
3. Invasiveness as evidenced by the epithelial growth, breaking through the basement membrane.

In 1910, I. C. Rubin expressed the opinion that the most important factor to consider is the intrinsic morphologic structure of the cell, and that invasiveness *is not* a requirement for diagnosis. This is the justification for the term "carcinoma *in situ*." It has been acclaimed by Broders, Graves, Pendleton, Schiller and Smith. Yet others tenaciously maintain that as long as there is no invasion *there is no carcinoma.* This conception is being subjected to some destructive criticism, however, in such work as was reported recently by Galvin, Jones, and TeLinde.[2] They reviewed a series of cases in which, some months and years previously, biopsies of the cervix had been performed. On review of 13 cases of cervical cancer, these biopsies were diagnosed as definitely showing carcinoma *in situ* in 11 cases. Certainly the percentage of positive diagnoses is quite high. Be that as it may, we must agree that once carcinoma *in situ* is present, it must surely do one of three things unless it is removed: (1) revert to nonmalignant epithelium; (2) remain as an intraepithelial process, or (3) become infiltrative and cause clinical signs and symptoms.

Whatever the outcome of the controversy, certainly evidence exists that forces the surgeon's hand and requires radical treatment of intraepithelial cancer *whenever* it occurs. One distinct aid in the diagnosis of carcinoma *in situ* is the site of occurrence of practically all the lesions. Foote and Stewart used a multiple block method in examining 27 pathologic specimens. By this study they confirmed the generally accepted view that the lesion originates about the external os, at the squamocolumnar juncture of the cervical epithelium. At this site the lesions are easily accessible for biopsy.

Pund and his associates[1b] described cervical carcinoma as follows:

1. Preinvasive carcinoma (carcinoma *in situ*); (Schiff's reagent shows no glycogen in hyperactive epithelium)
2. Covert invasive carcinoma, invasive malignant tumor without clinical evidence thereof
3. Overt carcinoma

He stated that preinvasive carcinoma ultimately becomes invasive after a variable period of latency, and here again we mention that this is the "margin of safety" by which many patients live.

### COMMENT

The problem of carcinoma of the cervix, according to the estimate of the New York State Department of Health, is no small one. Their estimate is that the probable incidence of carcinoma of the cervix is 2.5 per cent; i.e., that it develops in 11 women in 40. Roughly 95 per cent of cervical cancer is of the squamous cell type, and 5 per cent are adenocarcinomas. Prior to the advances in the microscopic study of carcinoma *in situ* the diagnosis of cervical carcinoma depended on gross evidence of clinical cancer.

Over a long period of years, the average age at the time of diagnosis has been 48. Very often, by the time the diagnosis was made, it was too late to offer the patient any hope. No operations are performed beyond Stages 0 to 1 by most surgeons, owing to spread.

Carcinoma *in situ*, diligently sought and ferreted out, gives modern diagnostic acumen a great opportunity to secure a good prognosis. The average age of women at the time of diagnosis of carcinoma *in situ* is approximately 36 years—twelve years sooner than diagnosis can be made on clinical grounds. These twelve years afford a margin for diagnosis that is almost unequaled in the case of any other malady. For twelve years, the physician and surgeon are literally forewarned that a clinical stage of a death-dealing neoplasm is on its way, and we *must not* disregard 'the handwriting on the wall" by treating the matter with little or no serious concern.

We realize that, from some quarters, serious, honest differences have arisen. Some question the assumption that the *in situ* phase is actually one of the earliest stages of squamous cell carcinoma of the cervix. The site of origin of carcinoma *in situ* has been described by many observers as the squamocolumnar juncture of cervical epithelium. Many pathologists have photographed abrupt changes from normal to abnormal (malignant) epithelium. It is our opinion that carcinoma *in situ* is definitely a precursor of clinical, cervical cancer. The question in our minds is NOT "Is carcinoma *in situ* an early stage of cancer?" but rather, "*How much* cervical cancer is preceded by carcinoma *in situ?*" If we could be certain that a great proportion of cervical cancer comes from the *in situ* phase and that the *in situ* phase arises from the squamocolumnar juncture of the cervix, then by thorough conization of the cervix when the patient reaches her thirty-fifth birthday, we should be able to remove the cause of approximately 20 per cent of the deaths among women in the United States. Certainly the fact that Galvin and TeLinde[2] observed 11 cases of carcinoma *in situ* in 13 cases of later proved cervical cancer adds evidence in support of the assumption.

Diagnostic procedures must procure evidence where the pathologic tissue is located. Various technics are used. The easiest procedure to carry out is a screening process by cytologic evaluation on the basis of a prepared smear. The average results from this procedure have given 1 positive diagnosis in approximately every 225 smears taken. The smear technic, however, is no better than the examiner's ability to read the slide, and it is an exacting and tedious undertaking at best. For this reason there are frequent expressions of doubt as to whether the expense of doing 224 "negative" smears is justified by the 1 "positive" smear gleaned. At an average cost of $15 per smear, which would include the office visit and [illegible] logists' charge, the cost of one positive diagnosis using the smear method would be approximately $3,375.00. Fantastic? Unreasonable? Unjustified? Incredible? Useless? We think not . . . *definitely not!*

The cost seems high, and truly it is. Yet who can say that the life expectancy of a young married woman, the mother of two or three children, or the wife, mother, sister, daughter or friend of any of us, is not worth $3,375, particularly when one considers that the average age of the women in whose cases positive diagnoses were made by this means has been only 36 years. Often we hospitalize a patient 70 or 80 years old, who has had a coronary thrombosis, or an elderly person who is actually in the terminal stages of a neoplastic or debilitating disease, whose foreseeable future is measured in terms of days or weeks rather than decades. Too, the high cost of hospitalization, operations, radium, roentgen study and physicians' services often amounts to as much in a case of cancer in the terminal stages (II to IV). Why, then, should we be recalcitrant when, by a technic as simple as a smear, we diagnose cancer of the cervix ten or twelve years ahead of time and thereby retain, perhaps, one of our own loved ones?

The next step from the smear is the cervical biopsy. This has been reported as successful in the diagnosis of carcinoma *in situ* in approximately 1.6 to 3.2 per cent of all biopsies of the cervix. The number of positive diagnoses made by the biopsy method is considerably greater than that achieved by the smear method. This is only to be expected, since the pathologist has bits of real tissue to examine and can take serial sections thereof. Certainly, if all other things are equal and available, a biopsy is much more satisfactory than a smear and should be done.

The most desirable way of studying the pathologic condition involved is with the "cold knife," a cone of the cervix being obtained by a minor surgical procedure in the operating room. The advantages of this method are as follows: (1) it does not disrupt tissue structure as does a cautery; (2) it affords tissue for study from the squamocolumnar portion of the cervix, and (3) it supplies the *entire* epithelial margin instead of several small, separated bites that may have missed the *in situ* growth.

Ayre,[9a] in 1948, described a special "cone knife" technic that makes it possible to remove the cone of tissue for study. Then, he suggested, if study reveals that the carcinoma is *in situ,* a simple Sturmdorf amputation of the cervix would be adequate treatment.

In the cases being here reported from the Gynecological Service of the Jefferson-Hillman Hospital, the patients have been handled in different ways, but the majority of them have undergone total hysterectomy. This has varied, with different surgeons, from the Wertheim type of operation down to the more conservative procedures. The consensus of the staff is that this is a malignant condition which should be treated more or less radically, by total hysterectomy. These cases were encountered over a three-year period:

In 1950 there were 701 gynecologic admissions; in 1951, 730, and in 1952, 684.

The patients were equally divided between white and Negro.

In cases of carcinoma *in situ* during pregnancy we are always more anxious, in our subsequent biopsies, to see whether the condition reverts to the normal after pregnancy is over. As to the management of the definitely diagnosed carcinoma *in situ* during delivery, it is our opinion that, all things being equal, it is safer to do a cesarean rather than a vaginal delivery. Carcinoma *in situ* is in the stage during which we can really do something for our patients. If we could get every woman to be examined every three or even every six months and obtain material for a smear or tissue biopsy from every site suggesting irritation or disturbance, we should pick up many more of these cases. The vaginal smear is a very valuable adjunct in the diagnosis of carcinoma *in situ* or any other type of carcinoma if well-trained persons are available to read the slides. It makes us more cancer-conscious, and when we have a "suspicious" case we follow it much more closely; also, the patient will stay with us better.

TABLE 2.—*Data in 14 Cases of Carcinoma in Situ*

| | |
|---|---|
| Average age, years | 37.3 |
| Youngest | 23 |
| Oldest | 49 |
| Average no. of pregnancies | 7 |
| Race: | |
| White | 7 |
| Negro | 1 |
| Single | 1 |
| Treatment: | |
| Abdominal hysterectomy | 8* |
| Vaginal hysterectomy | 1 |
| Cauterization—oophorectomy, etc. | 5 |

*(1 Wertheim)

## SUMMARY AND CONCLUSIONS

1. Carcinoma *in situ* is the early stage in which cancer is discovered. The average age of the patient is about 36 years. The authors report cases from the gynecologic department of the Jefferson-Hillman Hospital. There were 14 cases in one group and 7 in another. The average age of the patients was 37.3 years.

2. There was an equal number of white and of Negro patients in the group of 14.

3. The authors express the opinion that biopsies do not cause abortions or miscarriages, even though fairly deep "bites" of tissue are obtained. If bleeding follows, it may be controlled by applications of Monsel's solution by the use of Gelfoam or, if necessary, by the taking of a stitch or cauterization.

4. Radical operation should not be performed until a positive diagnosis of cancer *in situ* has been made by the pathologist. In the authors' opinion, there is time to get subsequent specimens before such radical treatment is undertaken.

5. As to the handling of carcinoma *in situ*, the authors consider that, if a patient below 35 years of age wants children and is where she can be watched carefully, a chance by watching her over a period of time, with repeated biopsies every three to six months. If she is above the age of 35 years, hysterectomy is probably the conservative method of treatment. The question as to whether any type of premature delivery or abortion is done depends, of course, a great deal on the individual patient, the stage of pregnancy, etc.

6. The borderline case is the one that may give us most concern, but carcinoma should always be thought of as a disease which kills, if left alone. Certainly, however, a positive diagnosis is required before radical treatment can be instituted.

7. Among the Service Cases for 1950, 1951 and 1952 there were 14 cases of carcinoma *in situ*. The carcinomas were detected by biopsies, routine in many cases, when no special irritation was noticed at the time of biopsy. Of the 2,115 patients admitted to the gynecologic service in the three years, there were 14 with carcinoma *in situ*—an incidence of 0.66 per cent of cases admitted to this service.

8. Tables are presented on the individual cases, a total of 14, the average age of patients diagnosed as having carcinoma *in situ* being 37.3 years. There were 7 white and 7 Negro patients.

9. It is emphasized that carcinoma *in situ* is a malignant disease even in the early stages. It should always be dealt with accordingly and should never be overlooked or forgotten.

## RÉSUMÉ

1. Le carcinome in situ est le stade précoce auquel le cancer est dépisté. Les auteurs rapportent des cas du service de gynécologie du Jeferson-Hillmann Hospital. Un groupe de malades comprenait 14 cas, l'autre 7. Age moyen: 37.3 ans.

2. Le groupe de 14 malades comprenait un nombre égal de femmes blanches et de noires.

3. Les auteurs pensent que les biopsies ne causent pas d'avortement ni de fausse-couche, malgré que l'on fasse des prélèvements assez profonds. Une hémorragie éventuelle peut être jugulée par des applications de solution de Monsel, par l'emploi de Gelfoam ou, c'est nécessaire, par un point de suture ou cautérisation.

4. L'opération radicale ne de[illegible] pratiquée qu' après confirmation [illegible] nostic par le pathologiste. Les [illegible] estiment qu'il y a assez de temps [illegible] prélèvements ultérieurs ava.

dre une opération aussi radicale.

5. Les auteurs considèrent que s'il s'agit d'une malade de moins de 35 ans désirant avoir des enfants, il faudrait pouvoir la suivre attentivement pendant une certaine période, en pratiquant des biopsies tous les trois à six mois. Si ell a plus de 35 ans, l'hystérectomie est à conseiller.

6. Le cas limite est celui qui peut nous causer le plus de soucis, mais le carcinome devrait toujours être considéré comme une maladie qui tue, si l'on ne s'en préoccupe pas.

7. Sur 2.115 malades admises dans le service de gynécologie du Jeferson-Hillmann Hospital au cours de ces trois dernières années les carcinomes in situ (14 cas) représentent 0.66 % des entrées.

## RESUMEN

1. El carcinoma *in situ* es el estadío temprano en el cual se descubre el cáncer. La edad promedio de las pacientes es de 36 años de edad. Los autores comunican los casos del departamento de ginecología del Hospital Jeferson-Hillman. Hubieron 14 casos en un grupo y 7 en otro. La edad promedio de las pacientes fué de37.3 años.

2. En el grupo de las 14 se presentó un número igual de pacientes blancos y negros.

3. Los autores expresan la opinión de que las biopsias no producen abortos aún cuando se obtengan "bocados" profundos. Si se presenta sangrado consecutivo, puede ser controlado por la aplicación de solución de Monsel, por el uso del Gelfoam ó si es necesario por una sutura ó cauterización.

4. La operación radical no debe llevarse a cabo hasta que se haga el diagnóstico de cáncer *in situ* por el anatomopatólogo. En la opinión del autor existe tiempo para obtener otros especímenes antes de que se realice dicho tratamiento radical.

5. Por lo que respecta al manejo del carcinoma *in situ*, los autores consideran que si una paciente por debajo de 35 años de edad desea niños y se encuentra en donde pueda ser observada cuidadosamente, puede vigilarse por un período de tiempo con biopsias repetidas de cada tres a seis meses. Si se encuentra por encima de 35 años de edad, la histerectomía es probablemente el método de tratamiento conservador. El problema de cuando hacera cualquier tipo de aborto ó parto prematura depende por supuesto, en una gran parte, de cada paciente, estadío del embarazo, etc.

6. Los casos incipientes son los que pueden confundir más, pero el carcinoma debe considerarse siempre como una enfermedad que mata si se la deja sola. Sin embargo, se requiere un diagnóstico positivo antes de que se instituya un tratamiento radical.

7. Entre los casos del Servicio de 1950 a 1952 se presentaron 14 casos de carcinoma *in situ*, habiéndose evidenciado dichos carcinomas por biopsias rutinarias en muchos casos, cuando no se notaba ninguna irritación especial al practicar la biopsia. De 2.115 pacientes admitidos al servicio de ginecología en los tres años, se presentaron 14 carcinomas *in situ* ó sea una incidencia de 0.66 por ciento de los casos admitidos al Servicio.

8. Se presentan cuadros sobre casos individuales, ó un total de 14, estando la edad promedio de las pacientes con carcinoma *in situ* diagnosticado, entre 37.3 años de edad, siendo 7 blancas y 7 negras.

9. Se señala que la enfermedad *in situ*, es maligna aún en los estadíos más tempranos. Debe de tratarse siempre por consiguiente, no olvidándose nunca ó pasándose desapercibida.

## ZUSAMMENFASSUNG

1. Unter einem Carcinoma *in situ* versteht man das Frühstadium, in welchem ein Krebs entdeckt werden kann. Das Durchschnittsalter der Patientinnen ist etwa 36 Jahre. Die Verfasser berichten über Kranke aus der gynäkologischen Abteilung des Jefferson-Hillman Krankenhauses. In einer Gruppe befanden sich 14, in einer anderen 7 Fälle. Das Durchschnittsalter der Kranken war 37,3 Jahre.

2. Die aus 14 Kranken bestehende Gruppe enthielt ebenso viel schwarze wie weisse Patientinnen.

3. Die Verfasser vertreten die Ansicht,

dass Probeexzisionen weder zu Früh- noch zu Fehlgeburten führen, selbst wenn ziemlich tiefe Gewebsfetzen herausgeknipst werden. Etwa auftretende Blutungen können mit örtlicher Anwendung von Monselscher Lösung, mit Gelfoam oder nötigenfalls mit einer Naht oder Kauterisierung kontrolliert werden.

4. Eine radikale Operation sollte nicht vorgenommen werden, solange nicht die positive Diagnose auf Carcinoma *in situ* von einem Pathologen gestellt ist. Nach Ansicht der Verfasser hat man Zeit für weitere Probeexzisionen, bevor man sich zu einem radikalen Eingriff entschliesst.

5. Was die Behandlung des Carcinoma *in situ* betrifft, so soll man nach Ansicht der Verfasser die Kranke, wenn sie jünger als 35 Jahre ist, Kinder haben will und einer sorgfältigen Beobachtung zugänglich ist, eine Zeit lang mit alle drei bis sechs Monate wiederholten Probeexzisionen verfolgen. Für Kranke von über 35 Jahren bildet die Gebärmutterresektion wahrscheinlich die konservative Methode der Behandlung. Die Frage, ob eine vorzeitige Entbindung oder eine Unterbrechung der Schwangerschaft einzuleiten ist, hängt natürlich zum grossen Teil vom individuellen Fall, vom Stadium der Schwangerschaft usw. ab.

6. Am schwierigsten sind die Entscheidungen in Grenzfällen. Stets aber muss man den Krebs als eine Krankheit betrachten, die, wenn sie nicht behandelt wird, zum Tode führt. Unter allen Umständen jedoch muss eine positive Diagnose gestellt sein, ehe ein radikaler Eingriff zulässig ist.

7. Unter den klinischen Fällen der Jahre 1950, 1951 und 1952 befanden sich 14 Kranke mit Carcinoma *in situ*. Die Krebse wurden durch Probeexzisionen entdeckt, die häufig, wenn noch keine besonderen Reizerscheinungen bemerkt waren, als routinemässige Massnahme ausgeführt wurden. Die 14 Fälle von Carcinoma *in situ* wurden unter 2115 innerhalb der drei Jahre in die gynäkologische Abteilung aufgenommenen Patientinnen entdeckt, was einer Häufigkeit von 0,66% der Aufnahmen entspricht.

8. Die einzelnen Krankengeschichten der 14 Patientinnen, sieben weisse und sieben schwarze, im Durchschnittsalter von 37,3 Jahren, die als Carcinoma *in situ* diagnostiziert wurden, sind in tabellarischer Form dargestellt.

9. Es wird hervorgehoben, dass das Carcinoma *in situ* eine bösartige Erkrankung ist, auch wenn es sich um ganz frühe Stadien handelt. Dementsprechend muss sie behandelt werden. Sie darf nicht übersehen werden oder in Vergessenheit geraten.

### RIASSUNTO

1. Il carcinoma "in situ" rappresenta il primo stadio nel quale il cancro può essere scoperto. L'età media è sui 36 anni. Nel reparto di ginecologia dell'Ospedale Jefferson-Hillman ve ne furono 14 casi con un'età media di 37 anni.

2. Bianche e negre erano in proporzioni uguali.

3. Gli autori sono del parere che i prelievi bioptici, anche se di notevoli quantità di tessuto, non disturbano il corso della gravidanza. Eventuali emorragie possono essere controllate mediante l'applicazione della soluzione di Monsel, di Gelfoam o, se necessario, con un punto di sutura o mediante cauterizzazione.

4. Finchè l'istopatologo non abbia fatto diagnosi sicura di carcinoma "in situ", non si deve operare radicalmente. Secondo gli autori c'è tempo di fare ulteriori esami prima di eseguire una cura radicale.

5. Quanto alla cura del carcinoma "in situ" gli autori considerano che, se si tratta di una paziente che abbia meno di 35 anni, voglia figli e abiti in un luogo ove possa essere seguita con cura, si può tenerla in osservazione per qualche tempo, con biopsie ripetute ogni 3-6 mesi; se invece la paziente abbia più di 35 anni, l'isterectomia è la cura di elezione.

6. Vi sono casi possono, nella indicazione terapeutica, preoccupare molto, ma bisogna sempre tener presente che il cancro è una malattia che uccide, se lasciato a sè. Certo, che prima di eseguirne la cura radic
occorre che la dia

7. La casistica personale, negli anni 1950, 1951 e 1952, comprende 14 casi di carcinoma "in situ," il più delle volte scoperti mediante biopsie. Poichè il numero delle pazienti ricoverate nel reparto ginecologico fu, ni quei 3 anni, di 2115, i 14 casi di carcinoma "in situ" costituiscono una percentuale del 0,66%.

8. L'età media delle 14 pazienti affette da carcinoma "in situ" fu di 37,3 anni. Di esse, 7 erano bianche e 7 negre.

9. Il carcinome "in situ" è una neoplasia maligna, per quanto in stadio precoce. Nella scelta della cura, pertanto, tale fatto non deve essere nè trascurato nè dimenticato.

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A good and careful writer often feels that the expression he has long been looking for in vain, and which he finds at last, is so simple and natural that it is the very one he would have expected to come at once into his mind without any effort.

Among the different words which can render any of our thoughts, there is but one which will do this well. It is not always forthcoming when we are speaking or writing. Still, it exists, and any other is feeble, and will not satisfy an intelligent man who aims at making himself understood.

There is in art a point at which perfection is reached, corresponding with the goodness or ripeness of Nature. He who feels and loves this has perfect taste, and he who likes what comes short of or exceeds this is faulty in his taste. There is, then, good taste and bad taste; and we are justified in discussing the difference between them.

—*La Buyère*

# Carcinoma in Situ of the Uterine Cervix: Report of a Case Observed for Two and a Half Years

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CARCINOMA *in situ* may be defined as carcinoma in its normal or original location. It has also been defined as "a condition in which malignant cells and their progeny are found in or near positions occupied by their ancestors before the ancestors underwent malignant transformation." A good definition is the one used by Hoffman, Farrell and Hahn,[1] who stated that carcinoma *in situ* denotes squamous cell carcinoma during the initial phase of its development, when the cells are still within the confines of the surface epithelium. The cells of carcinoma *in situ* are already regarded as malignant. Were they not, the term carcinoma, even though qualified by "*in situ*," would be a misnomer.

The following case is reported as of interest because the carcinoma *in situ* failed to become invasive over a period of two and a half years. Although this time lapse is not unusual, other cases have been described in which the basement membrane has been less resistant to invasion and the cancer has become invasive in a matter of months.

## REPORT OF CASE

R. B., a 36-year-old multiparous Negress, was admitted to the Crown Heights Hospital on Feb. 22, 1954, complaining of pain in the lower part of the abdomen.

*Chief Complaint.*—Pain was present for one day and was generalized over the lower part of the abdomen.

*Past History.*—*Menstrual:* The menses began at the age of 14, occurred every twenty-eight days and were four or five days in duration. *Marital:* The patient had been married twice, the first time at the age of 15 and the second (in 1942) at the age of 24. She had had numerous abortions and 4 full-time babies, 2 of whom are living. *Medical and Surgical:* The patient was first seen in a gynecologic clinic in September 1951 because of abdominal pain. A Papanicolaou smear showed the tumor to be of Type IV, and a biopsy was reported as revealing carcinoma *in situ* and leukoplakia of the cervix. She was followed with frequent punch biopsies and knife biopsies. The lesion remained unchanged until February 1953, when a biopsy was reported as showing invasive carcinoma of the cervix. She was then in the sixteenth week of pregnancy, and it was decided to carry the pregnancy to term. The antepartum course was uneventful. The patient was hospitalized from July 20 to July 31, 1953, for evaluation of the cervical lesion. The estimated date of confinement was July 25. On July 23 the patient went into labor, and cesarean section was carried out without complications.

The patient was again hospitalized on December 11, with complaints of abdominal pain starting twenty-four hours prior to admission. She had had one similar episode about five years earlier but was otherwise essentially well. She stated that exploration for supposed disease of the gallbladder had been performed at that time, and the surgeon was said to have found no cholecystic disease and to have left the gallbladder intact, although he removed the appendix.

*Physical Examination.*—There was tenderness to deep palpation in all abdominal quadrants, most marked in the midepigastrium, with questionable rebound tenderness in the same area.

*Roentgen Examination.*—A gastrointestinal series revealed a fairly constant smooth depression in the superior aspect of the duodenum, such as might be produced by continuity of an extrinsic mass, such as the gallbladder. A cholecystic roentgenogram showed subnormal excretion of the dye, with no calculi.

*Pelvic Examination.*—On December 17, examination of the pelvis [illegible]ealed [illegible] the cervix was firm and of [illegible] 7 [illegible] ec

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Submitted for publication April 15, 1954.

it showed a marked whitening patch 1.5 cm. in diameter. On the left and posterior aspect a wedge-shaped area of white was beginning to appear, but it was not as pale as that in the anterior region. No parametrical involvement was detected. Knife biopsies of the cervix were performed on December 18. The foci of carcinoma *in situ* were still present. (The same change noted prior to and during the early part of pregnancy, the features being those of carcinoma *in situ*.)

The patient was treated medically and was discharged on December 21. She refused operation and was advised to maintain a low fat diet plus sedation.

*Present Illness.*—Examination on Feb. 22, 1954, revealed a uterus as large as that of a two and one-half month gestation, with thickening of both tubes. The left ovary tender; it was enlarged to the size of a large walnut and was adherent to the lateral surface of the uterus. The cervix was eroded and showed a discharge. The impression was that of a fibroid uterus, a cystic ovary and (in view of the history) carcinoma of the cervix uteri. Total hysterectomy and bilateral salpingo-oophorectomy were advised.

*Laboratory Tests.*—Tests of the blood revealed 4,100,000 red cells per cubic millimeter, with 78.5 per cent (12.5 Gm.) of hemoglobin. The blood was type AB, and the blood was RH positive.

The specific gravity of the urine was 1.006. There was a slight trace of sugar, a slight trace of acetone and no albumin. Microscopic examination revealed a few red and white blood cells and many epithelial cells.

*Pathologist's Report.*—The pathologic diagnosis was (1) intraepithelial epidermoid carcinoma of the cervix; (2) endometrium in the lutein phase, and (3) minimal bilateral salpingitis.

*Operation.*—Complete hysterectomy, with bilateral salpingo-oophorectomy, was performed on February 23. The postoperative course was uneventful.

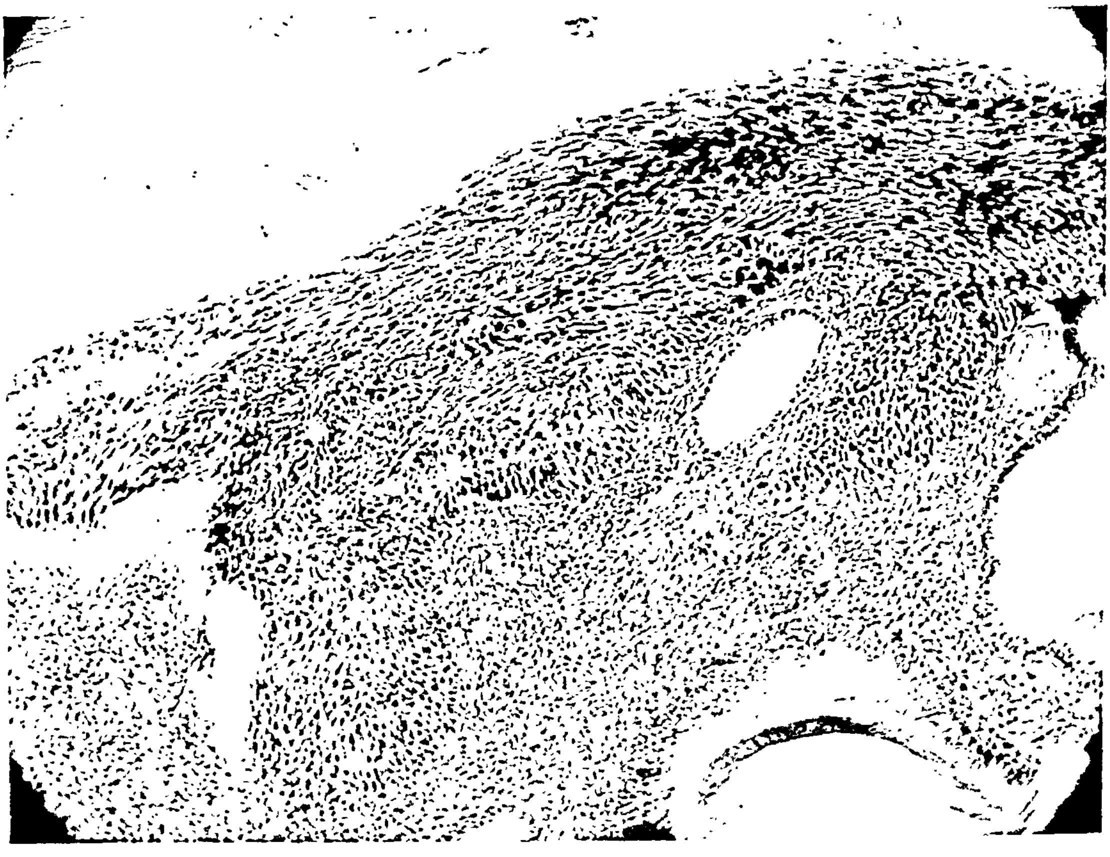

Fig. 1.—Low power photomicrograph of biopsy specimen of endocervical mucosa. (See text.)

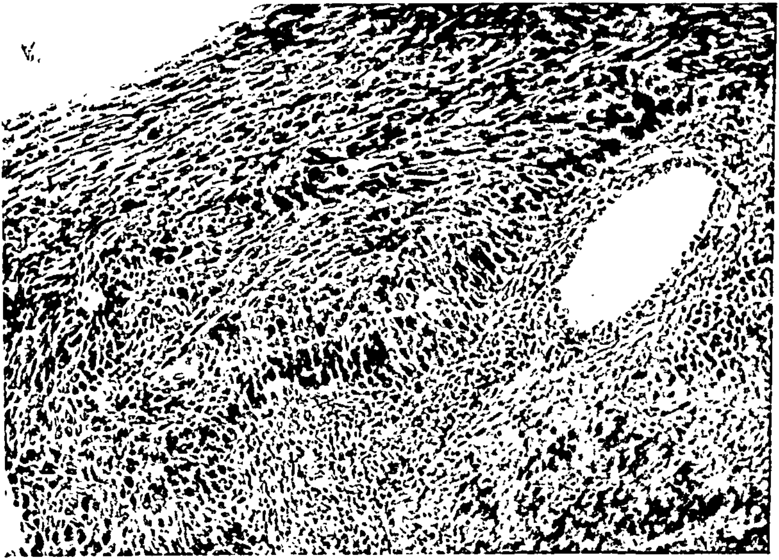

Fig. 2.—High power photomicrograph of endocervical mucosa. (See text.)

### COMMENT

This case is reported to show the relative safety of delay in operating upon a carcinoma *in situ* when a woman is of childbearing age, provided that she is not neglected and biopsies are performed at intervals of four to six months. The circular cold knife biopsy is preferred to the punch biopsy, as the latter may miss an affected area by not going deep enough. In this case the tumor appeared to be invasive for a short time during pregnancy, but later it regressed.

In such cases, delivery should be accomplished solely by cesarean section, as in this case, and hysterectomy should be performed at that time or after a relatively short period of observation. Although in this case the tumor appeared to be invasive during pregnancy, caution should be exercised in diagnosing malignant disease in a gestating cervix.

*Review of the Literature.*—Prior to 1912 it was generally agreed that squamous cell carcinoma of the cervix could be diagnosed with certainty only when unmistakable invasion had occurred. In 1912, Schottländer and Kermauner[2] published their observations on a series of frank invasive carcinomas of the cervix. They pointed out that the cervical epithelium at the verge of such a growth shows atypical changes that may well represent the cellular modifications characteristic of the earliest stage in malignant transformation of the squamous epithelium. In these marginal areas there was no break-through into the adjacent stroma, the atypical cells, as described by them, being still "*in situ*," i.e., still within the site of their origin. Confirmatory evidence produced by Hinselman,[3] Schiller,[4] Wespi,[5] Glatthar[6] and others is responsible for the bel rently shared by an ever-increasing group that it is possible to diagnose squamous cell carcinoma of the cervix with certainty before the malignant cells have broken through their original intraepithelial position.

*Incidence.*—The incidence varies with different writers and different conditions. Hoffman and his associates[1] observed only 1 case among 4,152 biopsies (about 1/40 of 1 per cent), while Pund and Auerbach[7] recorded 3.9 per cent of 1,200 removed uteri as so affected. Pund, Nettles and others,[8] in discussing these observations, stated that, while this exceeds the expected incidence of 1.5 per cent (Meigs[9]), it must be remembered that total hysterectomy was elected for cervical disease.

*Pregnancy.*—According to Pemberton and Smith,[10] cancer of the cervix is preceded by pregnancy in 90 to 97 per cent of cases.

*Age.*—Nieburgs[11] noted that the highest incidence of cervical cancer *in situ* is in women between the ages of 30 and 40. However, it averages 0.8 per cent for each decade after puberty. Pund and Auerbach[7] stated that the average age of 43 patients was 36.6 years. The youngest patient was 23 and the oldest 56. TeLinde and Galvin[12] gave 36 years as the average for the extremely early stages and 48 as the age for overt tumor. In comparison, they remarked that the relative youth of the patients with preinvasive carcinoma is rather startling and the twelve-year difference is impressive.

*Opinions as to Malignancy.*—Some treat carcinoma *in situ* as already malignant (Broders).[13] Others regard it as potentially so. Still others imply that it is not (Younge, Hertig and Armstrong).[14] Hoffman and his associates[1] have stated that there is also some difference of opinion as to what constitutes invasion, and consequently much confusion as to where the line between "*in situ*" and invasive carcinoma should be drawn. To support a diagnosis of invasive carcinoma, some require that there be extension of the atypical cells beyond the basement membrane, with actual infiltration of the fibromuscular stroma, while others accept extension of the squamous cells below the surface of the epithelium into the cervical glands. At the other extreme are those who believe that "minimal stromal invasion" or questionable invasion of the basement membrane does not exclude a case from the *in situ* category. Most authors agree that the term *in situ* should be used when the cells are within the confines of the surface epithelium. Hoge[15] stated that the cell changes of cancer *in situ* are identical with those of the frankly invasive type. He added that the subject is a controversial one. Furthermore, even among pathologists who maintain the concept, there will be those who will disagree in specific cases. In many cases the microscopic picture will be "borderline" and the diagnosis uncertain.

*Recent Literature.*—Skapier[16] detected 21 carcinomas *in situ* of the cervix by means of the Papanicolaou technic in a series of 10,000 cases, all confirmed by biopsy. A description of the type of cells observed in such cases is given. Skapier stated that characteristic of the cells observed in malignant growths, either invasive or noninvasive, can often be better demonstrated in smears from the isolated cells than in tissue sections. Strikingly enough, the exfoliated malignant cells of preinvasive cancer are detected prior to the appearance of a visible malignant focus.

Hoge[15] described the appearance of the cells of carcinoma *in situ* and added that, in 17 or more cases reported in the literature by several writers, these intraepithelial changes have preceded invasive carcinoma of the cervix and in many instances have found to coexist with it. There is evidence that intra-epithelial carcinoma may exist for years before invasion occurs. Pund and Auerbach[7] suggested that invasion begins about six years after the preinvasive phase and that another six years may pass before ulceration becomes obvious.

Pund, Nettles and Dick[8] stated that the majority of carcinomas of the cervix pass through three phases: preinvasive, covert invasive and overt invasive.

Hoffman, Farrell and Hahn[1] observed only 1 carcinoma *in situ* of the cervix among 4,152 biopsy specimens, although 9 invasive squamous cell carcinomas were discovered. They stated that the low incidence of carcinoma *in situ* in their series was in contrast with higher figures elsewhere. These authors also pointed out the dangers inherent in indiscriminate diagnoses of carcinoma *in situ*. The need for circular biopsy to insure adequacy of the specimen, multiple sections to exclude invasion and repeated biopsies to determine the reversibility or irreversibility of the lesion is stressed. Routine cervical biopsies are recommended as a means of detecting more cervical carcinomas while they are still amenable to treatment.

Nieburgs[11] studied 14 cases by smears over periods of one and one-half to three years. Progressive morphologic cellular changes were observed, from benign nuclear changes to definite preinvasive cancer cells and, in 3 cases, to early invasion.

Reagan and Hicks [17] made a five year study of 5,044 cervices from amputations, hysterectomies and biopsies, including conization (cold knife) and punch biopsies. Carcinoma *in situ* was present in 100 cases (about 2 per cent). Two hundred and twenty-five squamous cell carcinomas were simultaneously observed.

Mullen and Foraker[18] stated that in their opinion carcinoma *in situ* of the cervix, as well as its relation to pregnancy, requires much more investigation. In cases similar to the one they reported, follow-up studies extending over many years, if possible, will be needed in order to obtain an understanding of the history of this lesion. At present, they maintained, the diagnosis of carcinoma *in situ* of the cervix during pregnancy is fraught with hazard; pregnancy should not be interrupted, and definitive treatment for carcinoma *in situ* should not be undertaken until an adequate postpartum follow-up of well over six months has been carried out.

## SUMMARY

1. A case of carcinoma *in situ* of the cervix, observed over a period of two and a half years without showing invasiveness, is reported. The patient became pregnant and was delivered by cesarean section. The cervical lesion was temporarily invasive during pregnancy and then regressed to the *in situ* type. A hysterectomy was subsequently performed.

2. Papanicolaou smears are useful as a screening test for carcinoma *in situ* or invasive carcinoma but should always be confirmed by biopsy.

3. The best method of taking a biopsy specimen is the use of a circular cold knife or a cold knife conization. A punch biopsy is useful only when the results are positive; otherwise one is not sure it has not missed an affected area.

4. The concept of carcinoma *in situ* has been almost universally accepted. A small minority, however, still disagree with the concept.

5. The treatment for carcinoma *in situ* is complete hysterectomy. During the childbearing age, however, it is safe to wait, provided biopsies are performed every four to six months and deliveries are made by cesarean section.

6. The ideal time for hysterectomy for treatment of carcinoma of the cervix is during the preinvasive stage. This may be regarded as a life-saving measure.

*Author's Note*: I wish to express my thanks to the Kings County Hospital for furnishing me with the details of the early history of the patient whose case I have described.

## RÉSUMÉ

1. Description d'un cas de carcinome in situ du cervix, suivi pendant deux ans et demi, sans envahissement ganglionnaire. Grossesse, avec *prolifération temporaire* de la tumeur. Accouchement par césarienne. Hystérectomie.

2. Les frottis de Papanicolaou sont utiles dans ces cas, mais le diagnostic devrait toujours être confirmé une biopsie.

3. La meilleure biopsie s'obtient à l'aide d'un bistouri recourbé.

4. L'idée d'un carcinome in situ a été presque universellement acceptée.

5. Traitement: hystérectomie total

6. L'époque idéale pour l'hystérectomie est celle qui précède l'envahissement.

### RESUMEN

1. Se comunica un caso de carcinoma *in situ* del cérvix observado durante un período de dos años y medio en que no demonstró invasión. La paciente se embarazó y dió a luz por cesárea. La lesión cervical fué invasora temporalmente durante el embarazo, involucionando posteriormente al tipo de *in situ*. Se hizo histerectomía.

2. Los frotis de Papanicolaou son útiles como una prueba gruesa para el carcinoma *in situ* ó é carcinoma invasor, pero debe de ser comprobada siempre por biopsia.

3. El mejor método para tomar biopsia es el uso de un bisturí circular frío ó una conización con bisturí frío. La biopsia por punción es útil únicamente cuando los resultados son positivos, de otra manera no se está seguro de que se ha perdido una área afectada.

4. El concepto de carcinoma *in situ* ha sido aceptado casi universalmente. Sin embargo hay una pequeña minoría que aún está en desacuerdo con el concepto.

5. El tratamiento para el carcinoma *in situ* es la histerectomía total. Sin embargo, durante el embarazo es mejor esperar, teniendo en cuenta que deben tomarse biopsias de cada cuatro a seis meses y de que los partos deben hacerse por cesárea.

6. El tiempo ideal para la histerectomía, para el tratamiento del carcinoma del cérvix, es durante el estadío preinvasor. Esto debe de ser considerado como una medida para salvar la vida.

### ZUSAMMENFASSUNG

1. Es wird über einen Fall von Karzinom des Gebärmutterhalses *in situ* berichtet, der während einer Beobachtungszeit von zweieinhalb Jahren kein Eindringen in die tieferen Gewebe zeigte. Die Patientin wurde schwanger und wurde mittels Kaiserschnitts entbunden. Während der Schwangerschaft zeigte der Krankheitsherd am Gebärmutterhals vorübergehen de Zeichen des Eindringens in das anliegende Gewebe, kehrte aber später in das *in situ*—Stadium zurück. Danach wurde eine Gebärmutterresektion vorgenommen.

2. Abstrichuntersuchungen nach Papanicolaou sind zur Aussiebung von Patientinnen mit *in situ*-oder infiltrierenden Karzinomen von Wert, sollten aber stets durch Probeexzisionen bestätigt werden.

3. Die Probeexzision wird am besten mit einem ringförmigen kalten Messer oder als kegelförmige Ausstanzung durchgeführt. Die Abknipsung eines kleinen Gewebestücks ist nur dann befriedigend, wenn die Untersuchung positiv ausfällt; andernfalls kann man nicht sicher sein, ob man wirklich das erkrankte Gewebe getroffen hat.

4. Der Begriff des Carcinoma *in situ* ist jetzt fast auf der ganzen Welt anerkannt. Ein kleine Minderheit allerdings steht noch immer im Widerspruch dazu.

5. Die Behandlung des Carcinoma *in situ* ist die totale Gebärmutterresektion. Im gebärfähigen Alter jedoch gilt es als gefahrlos abzuwarten, vorausgesetzt dass Probeexzisionen alle vier bis sechs Monate vorgenommen und Entbindungen mittels Kaiserschnitts ausgeführt werden.

6. Der ideale Zeitpunkt zur Gebärmutterresektion beim Zervixkarzinom liegt im Stadium vor er Infiltrierung tieferer Gewebe. Unter diesen Umständen kann die Operation als lebensrettendes Verfahren angesehen werden.

### RIASSUNTO

1. Viene riferito un caso di carcinoma in situ del collo uterino, seguito per un periodo di 2 anni e mezzo senza che mostrasse segni di invasione. La donna ebbe una gravidanza e partorì con taglio cesareo. Durante la gravidanza la lesione mostrò, per qualche tempo, una tendenza a espandersi, poi regredì fino allo stadio intraepiteliale. Successivamente fu sottoposta ad isterectomia.

2. La citodiagnosi secondo Papanicolaou è molto utile per la diagnosi di questi tumori, ma deve essere confermata dalla biopsia.

3. Il concetto di "carcinoma in situ" è ormai universalmente accettato, salvo qualche opinione discorde.

4. La sua cura è l'isterectomia totale. Si può, tuttavia, temporeggiare durante il periodo di fecondità, a patto che si eseguiscano biopsie ogni 6 mesi e che i parti avvengano con taglio cesareo.

5. L'epoca più adatta per l'isterectomia è quella corrispondente alla stadio preinvasivo; solo in questo caso la cura può essere efficace.

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> *With five or six technical terms, and nothing further, a man will pose as a connoisseur of music, pictures, architecture, and dining. He thinks he takes more pleasure in hearing and seeing and eating than the common run of folk. He imposes upon others, and deceives himself.*
>
> —*Vauvenargues*

# Papillary Cystadenocarcinoma of the Pancreas

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NEOPLASTIC disease of the pancreas is a relatively common surgical entity. By far the most frequent type from a clinical standpoint is carcinoma, which may occur in any portion of the pancreas, though the usual location is the pancreatic head. The next most prevalent site is the body; rarely is the tail of the pancreas involved. Secondary invasion of e pancreas by malignant disease is also airly common. Cystic disease of the pancreas may arise from various portions of its body. Papillary cystadenocarcinoma is a rare disease of the pancreas; consequently, our interest in reporting this case is because of its rarity, and because of the unusual symptoms in this patient with the early good results obtained. Burk and Hill[1] in 1952 classified neoplastic disease into three types, cystadenoma, cystadenocarcinoma and teratoma, stating that the cystadenoma occasionally shows papillary proliferations. Lichtenstein[2] in 1934 reported a case of papillary cystadenocarcinoma in the tail of the pancreas, stating that he was unable to find any previous authentic cases in the American literature. His patient was a 44-year-old woman who had had demonstrable cystic disease of the pancreas for six years, mistakenly diagnosed as enlargement of the spleen. From the necropsy data he assumed that this growth originated as a benign cystadenoma and progressed to late malignant changes, which accounted for the rapid decline of the patient in the few months prior to death. Miller, Baggenstoss, and Comfort[3] reported an autopsy study of 202 cases of primary carcinoma of the pancreas at the Mayo Clinic. In this series they observed only 1 papillary cystadenocarcinoma, which revealed large cystic spaces lined by tall columnar epithelium, with the papillary projections associated with malignant disease. Kaufmann,[4] in a German publication in 1911, reported an authentic case of this disease.

Pancreatic cysts probably originate in ectopic embryonic cells as proliferations of ductal or acinar epithelium. The development and rate of growth of these cysts is entirely unpredictable, but it is known that they may be present for many years in a benign state or a very slow growing malignant state. Their presence may not be manifested for a considerable time, and the symptoms finally result from complications, such as jaundice, torsion, hemorrhage, rupture, pain from trauma, the pressure mechanically produced by encroachment on surrounding structures, or the transformation from a benign to a malignant state, with direct or metastatic extension. We are not certain whether the papillary cystadenocarcinoma in the case to be reported had been producing any symptoms or not, as primary laparotomy was done for relief of acute cholecystitis. After encountering a large cystic mass, we are still unable to say which was causing the symptoms in the absence of jaundice and evidence of obstruction of the common bile duct. A complete review of the case, however, will be presented.

*Incidence.*—Pancreatic disease is rather common, and carcinoma of the pancreas, which is one of the most significant diseases of this organ, is comparatively rare. Cysts of the pancreas occur much less frequently than do carcinoma, and carcinomatous change in pancreatic cysts is reported very infrequently. The correlation of pancreatic cysts and disease of the gallbladder cannot be proved, but Judd[5] stated that the association of cholecystic disease and pancreatic cysts is very common; in a

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series of 41 cases there was associated disease of the gallbladder. This probably holds true in our case, as the patient had undergone two previous operations on the gallbladder and still had cholecystic disease.

*Location.* — Several writers have reported cystadenoma and papillary cystadenoma as originating in the tail of the pancreas. Heiberg[6] stated that in his opinion the favorite site of cystadenoma is the tail of the pancreas. Lazeras[7] stated that the rarest position for pancreatic cysts is in the head of the pancreas. Kennard[8] reported a series of 20 carcinomas of the head of the pancreas, many of them cystic, but it is questionable how many of them were true proliferative cystadenocarcinomas, as the evidence reported is insufficient to prove the complete pathologic diagnosis. Miller,[3] reporting a series of 202 autopsies on carcinoma of the pancreas at the Mayo Clinic, observed only 1 papillary cystadenocarcinoma. Friendenwald and Cullen[9] in a short review of 7 pancreatic cysts, said that only 3 showed malignant change. Mahorner and Mattson[10] observed 4 cysts with carcinomatous change at operation, in a series of 88 pancreatic cysts. A relatively high incidence, but this was a clinical review of the cysts discovered in a large series of patients.

*Age Incidence.*—This is a disease of middle life, but it has been reported as occurring from the second to the seventh decade. It is surprising, however, that most of the patients whose cases are reported were in the fourth decade. Kaufmann[4] reported, in his textbook on anatomy, a case of papillary adenocarcinoma in a 42-year-old woman. Lichtenstein reported a case in which the patient, also a woman, was 44 years old. We are of the opinion that the few of Kennard's patients whose lesions resembled papillary cystadenocarcinoma were in the fourth decade, probably 1 in the third. Our patient was a women 64 years of age.

*Sex Incidence.*—The sex incidence shows that the male and the female are equally susceptible to this disease. Oser[11] reported that there were 61 female patients in a series of 121 cases of pancreatic cyst. In Kennard's 21 reported cases, 10 patients were male and 11 female.

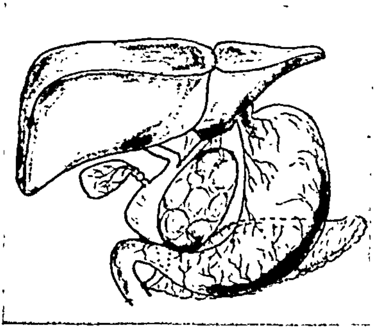

Fig. 1.—Cystic mass compressing the common duct laterally and the portal vein and hepatic artery posteriorly.

*Complications.* — The complications of this disease are the same as those for all carcinomas of the pancreas. They vary to a great extent according to the anatomic location of this pathologic process, whether it involves the head, the body or the tail of the pancreas. The complications are usually: (1) ductal obstruction or pancreatic destruction due to local involvement of the pancreas, or (2) invasion of or pressure on surrounding structures by direct growth and by metastasis. A few of the complications will be briefly discussed.

1. *Dilatation of the Common Bile Duct:* If the tumor mass involves the head of the pancreas, a very early growth may cause obstruction of the ampulla of Vater, the lower end of the common bile duct or the pancreatic duct. If the mass is cystic and extends out from the pancreas it may encroach upon the path of the common bile duct, causing obstruction; this occurred in our patient. In this instance the growth, which originated from the head of the pancreas, had extended cephalad into the gastrohepatic ligament and caused wide seperation of the portal vein, the hepatic artery and the common

bile duct. The common bile duct had been compressed a considerable distance to the right and was moderately dilated, owing to pressure of this growth either at the lower end of the duct or at the ampulla.

2. *Jaundice*: Jaundice, of course, varies according to the origin of the original tumor. Jaundice may be present if the growth involves the head of the pancreas and the region of the sphincter of Oddi. Early jaundice is due to pressure in this area and obstruction of the common bile duct (posthepatic jaundice). Jaundice may also result from metastatic invasion of the liver, with interlobular obstruction. In the case we shall present there was no evidence of jaundice, in spite of the fact the head of the pancreas was involved and hat the tumor was large, causing considerable pressure and distention of the common bile duct.

3. *Suppuration*: In many carcinomas of the pancreas a suppurative process surrounds the periphery or the advancing edge of the carcinoma. Miller, Baggenstoss and Comfort[3] reported in their autopsy series that in 19 per cent of cases there was some type of early inflammatory lesion or suppuration. In our case no inflammation associated with the carcinoma.

4. *Venous Thrombosis*: The commonest involvement of venous channels associated with this disease is observed in the portal vein. There also seems to be a tendency toward association of a migratory type of venous thrombosis with carcinoma of the pancreas involving distal vessels (ileofemoral, renal, etc.), but no venous involvement occurred in our case, in spite of the very large invading cystic lesion.

5. *Involvement of Perineural Lymph Spaces*: This, according to the autopsy reports has been observed in a rather large number of cases, at least one-third of the total. It is an invasive process and is more common with lesions of ductal origin than with those of the acinar group. Again, our patient showed no evidence of lymph space involvement.

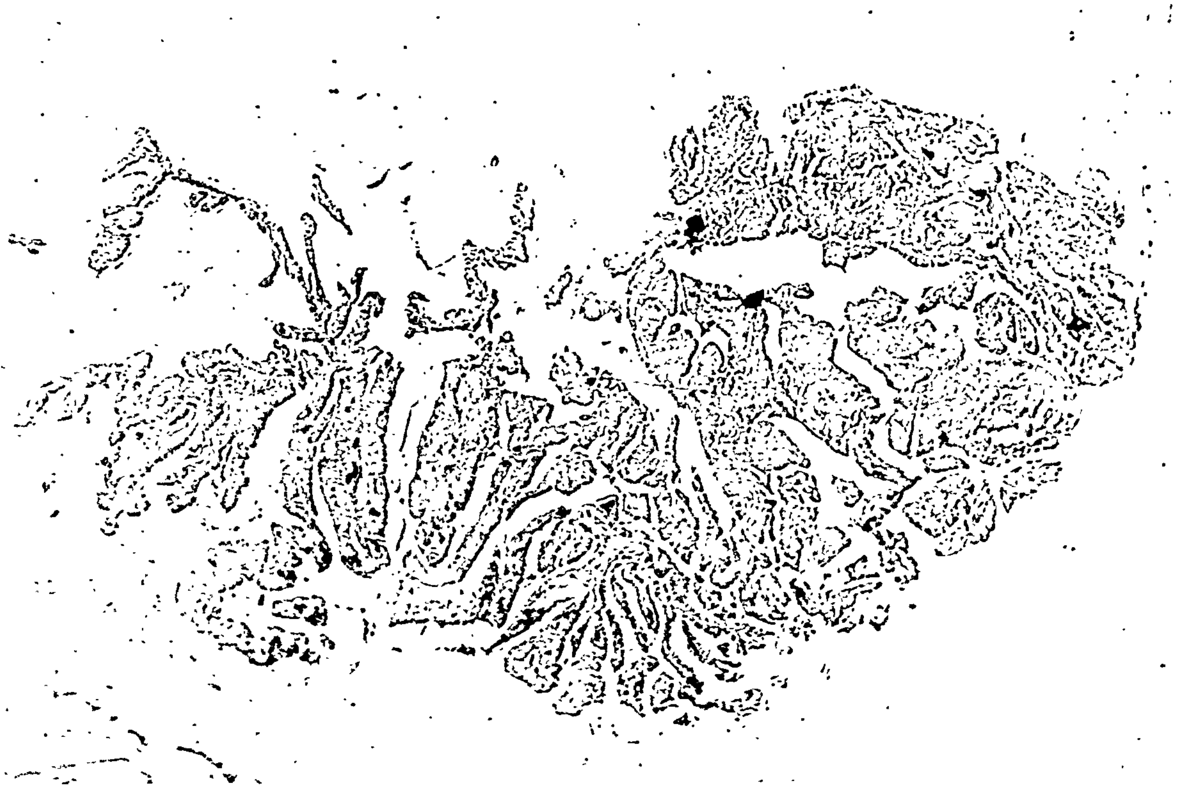

Fig. 2.—Gross magnification, showing portions of cyst wall and projecting intracystic papillary lesion.

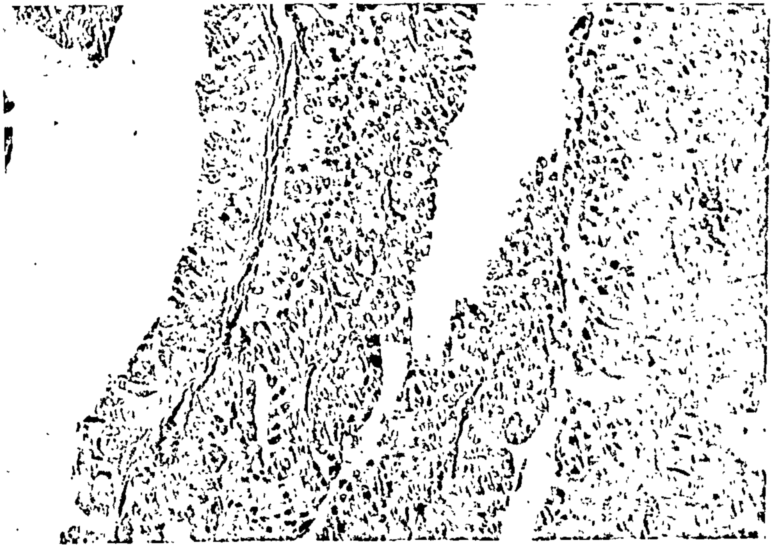

Fig. 3.—[illegible] of intracystic papillary lesion. Note vascularized c[illegible] multilayer epithelial cells with moderate anaplastic features, as evidenced by scattered hyperchromatic nuclei and occasional mitotic figures. Some tendency for fusion of cellular papillae.

6. *Metastasis*: This is a late complication of carcinoma of the pancreas regardless of type. It is frequently discovered at operation and is practically always detected at autopsy if death has been due to carcinoma of the pancreas. The high incidence of metastasis is of course easily understood, owing to the fact that the diagnosis is often made late in the course of the disease. The spread is usually to the lymph nodes, liver, lungs, peritoneum and adrenal glands. Our patient showed no evidence of metastasis at operation, and at the time of writing, almost a year later, she is in excellent health. Apparently no metastases have developed.

*Pathologic Picture.*—Lichtenstein[1] classified pancreatic cysts associated with malignant disease as follows: (1) solid adenocarcinomas with epithelium-lined cysts; (2) epithelium-lined cysts of the pancreas and carcinoma of the pancreas, the lesions being present simultaneously in the organ but not associated with each other, and (3) papillary cystadenocarcinomas.

There are a few clear-cut examples of papillary cystadenocarcinoma, but textbooks describe the lesions rather meagerly. The lesion in our case represented a rare situation with a pathologic condition involving the head of the pancreas. Many authors have expressed the opinion that the beginning process is a benign cystadenoma, which later undergoes malignant degeneration. The ultimate tendency of papillary cystadenomas of the ovary to pursue a malignant course is well known, and these lesions exhibit a marked histologic resemblance to cystadenoma of the pancreas. The neoplasms are characterized by aggregated cystic spaces of various sizes, with portions of the growth exhibiting a solid structure. Histologically the cystic spaces are lined by cuboidal or closely applied tall columnar cells with relatively dense cytoplasm. The cystic structures infiltrate the surrounding tissue, and papillary infoldings are common. Areas of marked anaplasia on the part of the epithelial cells to formation of solid masses may also occur. The solid areas may exhibit a picture characteristic of adenocarcinoma of the pancreas.

### REPORT OF CASE

L. A. F., a woman aged 64, had had mumps, measles and chickenpox in childhood and pneumonia at the age of 17. Her mother died of a "heart attack" at the age of 42 and her father in an accident at the age of 69. There was no history of cholecystic or intestinal disease in the family. The patient had the first attack of gallbladder colic in 1913. These bouts of pain became so severe that in 1914 she was hospitalized for surgical treatment, and a cholecystotomy and appendectomy were performed. She states that the right ovary was removed and a section of bowel resected. "Gallstone" colic recurred in less than one month after this operation. In 1926 the patient was hospitalized for "inflammation of the gallbladder." She was seriously ill, but no operation was performed. The attacks continued, growing more severe, until 1936, when operation was repeated. She was informed that a cholecystectomy had been done. In 1939 she underwent a subtotal abdominal hysterectomy for a fibroid uterus.

After the operation in 1936, the patient stated, the attacks were so severe that she was anesthetized with chloroform before the doctor could make an examination of her abdominal area. There was never a period longer than eight to ten weeks between attacks. She was also informed that she had had a peptic ulcer intermittently since 1913, but we are unable to determine that this was substantiated by roentgen study.

The patient was admitted to St. Francis Hospital on Oct. 29, 1952, because of nausea, vomiting and pain in the right upper quadrant of the abdomen. She had been unable to eat anything for three days and had had similar attacks in the past few weeks. Owing to the frequency of these attacks and her inability to tolerate the pain and maintain normal nutrition, she was admitted for cholecystectomy. The diagnosis of cholecystitis was questioned, since she had already undergone cholecystotomy and a supposed cholecystectomy. In spite of this, the gallbladder that visualized was about two-thirds the normal size. The urine was normal. There were 4,050,000 red blood cells per cubic millimeter, with 13.4 Gm. of hemoglobin, and 7,400 white cells, with a normal differential count.

After one blood transfusion, operation was performed. A right rectus incision was made, with excision of an old scar, and on exploration of the abdomen many adhesions were encountered. These were separated by sharp and blunt dissection. The gallbladder was finally exposed. It was about three-fourths the normal size and contained bile. The duct system was explored. The common duct was dilated and pushed far to the right, traversing around a multilocular cystic mass about 5 by 4 by 4 inches (12.5 by 10 by 10 cm.). This mass was anterior to the portal vein and the hepatic artery and medial to the common duct. The peritoneum was separated from the mass and the bleeding vessels ligated. The mass was then peeled out by sharp and blunt dissection down to the pancreas, where it was inadvertently ruptured, and a papillary type of tissue was observed, resembling carcinoma. This was removed as cleanly as possible, together with some pancreatic tissue, and sutured over. The gallbladder was then removed and the abdomen closed, after the placing of a Penrose drain in Morrison's pouch. The patient made a slow but satisfactory recovery and left the hospital in two weeks.

After the operation the wound drained a considerable amount of pancreatic ferment, which was quite troublesome to the surrounding skin. After about three weeks all drainage ceased. At the time of writing the patient is gaining weight and feels better than she has for years. It is now almost a year since the operation.

### SUMMARY

A case of papillary cystadenocarcinoma of the pancreas is reported and the literature reviewed. Whether the lesion was a long-standing cyst of the pancreas which had recently undergone malignant change or was primarily a malignant disease is impossible to say. In the author's opinion, however, it is reasonable to assume that

some of the longstanding obscure epigastric symptoms may have been due to the pressure of this cystic growth, as the patient's health has been definitely improved since its removal.

### ZUSAMMENFASSUNG

Es wird über eine Fall von papillärem Zystadenokarzinom der Bauchspeicheldrüse berichtet und ein Überblick über die einschlägige Literatur gegeben. Es lässt seich nicht sagen, ob es sich im vorliegenden Falle um eine seit langem bestehende Pankreaszyste, die schliesslich bösartig degenerierte, oder um eine primäre Krebserkrankung handelte. Nach Ansicht des Verfassers allerdings geht man wohl nicht fehl in der Annahme, dass manche der ungeklärten lange bestehenden epigastrischen Symptome des Kranken durch Druck der zystischen Geschwulst hervorgerufen waren, da das Wohlbefinden des Patienten sich nach Resektion der Geschwulst deutlich gebessert hat.

### RESUMEN

Se comunica un caso de cistoadenocarcinoma papilar del páncreas y se revisa la literatura. No es posible definir si la lesión fué nun quiste viejo del páncreas que se malignizó ó si fué un padecimiento maligno primario. En la opinión del autor, es razonable pensar que algunos síntomas epigástricos viejos pudieron ser debidos a la presencia del crecimiento quístico, ya que la salud del paciente mejoró en forma definida después de la extirpación.

### RIASSUNTO

Viene riferito un caso di cistoadenoma-papillifero del pancreas, con rassegna della letteratura sull'argomento. Non è possibile stabilire se si tratti di una cisti pancreatica di vecchia data, trasformata poi in tumore, oppure di un tumore primitivo. L'autore pensa che una dispepsia oscura, che datava da anni, potesse dipendere dalla compressione causata dalla cisti, tanto è vero che questa scomparve completamente dopo l'intervento.

### SUMARIO

Os autores comunicamum caso de cistoadenoma papilar do pâncreas e apresentamuma revisão da literatura. Não foi possível afirmar si a lesão era constituida por um cisto pancreático de longa duração que havia recentemente sofrido uma modificação maligna ou, si era primariamente maligno. Na opinião dosautores, entretanto, é razoável pensar-se que alguns dos sintomas epigástricos, obscuros, de longa duração, podem ser devidos a pressão dêste crescimento cístico, uma vêz que o paciente melhorou consideravelmente após a remoção do mesmo.

### RÉSUMÉ

L'auteur rapporte un cas d'adénocarcinome kystique papillaire du pancréas et passe en revue la littérature. Il est impossible de dire s'il s'agit d'une dégénérescence primaire ou secondaire d'un kyste pancréatique. Toutefois, il est raisonnable de supposer que si les symptômes épigastriques, dus à la pression exercée par la croissance du kyste, disparaissent après l'extirpation du kyste, on est en droit de penser qu'il s'agissait d'un kyste bénin.

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Women, as the object of our strongest love and aversion, rouse complex emotions which are embodied in proverbial "wisdom."

Almost everybody allows himself or herself some entirely unjustifiable generalization on the subject of Woman. Married men, when they generalize on that subject, judge by their wives; women judge by themselves. It would be amusing to write a history of men's views on women. In antiquity, when male supremacy was unquestioned and Christian ethics were still unknown, women were harmless but rather silly, and a man who took them seriously was somewhat despised. Plato thinks it a grave objection to the drama that the playwright has to imitate women in creating his female roles. With the coming of Christianity woman took on a new part, that of the temptress; but at the same time she was also found capable of being a saint. In Victorian days the saint was much more emphasized than the temptress; Victorian men could not admit themselves susceptible to temptation. The superior virtue of women was made a reason for keeping them out of politics, where, it was held, a lofty virtue is impossible. But the early feminists turned the argument round, and contended that the participation of women would ennoble politics. Since this has turned out to be an illusion, there has been less talk of women's superior virtue, but there are still a number of men who adhere to the monkish view of woman as the temptress. Women themselves, for the most part, think of themselves as the sensible sex, whose business it is to undo the harm that comes of men's impetuous follies. For my part I distrust *all* generalizations about women, favorable and unfavorable, masculine and feminine, ancient and modern; all alike, I should say, result from paucity of experience.

—*Russell*

# A Forgotten Cause of Infant Suffocation

## The Possible Relation Between Atresia of the Posterior Nares to Asphyxia Neonatorum and Sudden Infant Death

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THE primary purpose of this article is to create and promote a provocative discussion, as well as to stimulate and revive an increased interest in the forgotten relation between a congenital anomaly, atresia of the posterior nares and asphyxia neonatorum. This paper is also presented to state some of my personal views on this subject and, in addition, to encourage further investigation and research work on this relation. It is likewise intended to urge the pathologist to determine whether the atresia in infants is bony or membranous, and to investigate the posterior nares in all cases of asphyxia neonatorum and of the mysterious deaths of infants up to about 5 months of age, when no other cause of suffocation can be found.

The profession today is at a loss to explain the exact cause of infant death in a number of cases, and the diagnosis and responsibility are placed upon the vague term "accidental mechanical suffocation," because at autopsy no definite pathologic change, gross or microscopic, can be found to explain the death. It is my firm conviction that, if the pathologist would investigate posterior nares in all such cases, he might be amazed at the frequency with which he would find this anomaly to be present.

Almost everyone can recall reading news items concerning infants who, although apparently sound and healthy, were found dead in their cribs or carriages. Such headlines as these appear: "Baby Dies, Apparently of Suffocation," "Baby Drowns in a Pool of Milk," etc. These deaths are usually classified by those who compile vital statistics as "death from mechanical or accidental suffocation." In the absence of any other familiar pathologic condition, death may very well have been due to unrecognized unilateral atresia of the posterior nares.

In reading articles published on asphyxia neonatorum and sudden deaths in infants,[1] one is impressed with the doubt that exists as to the exact cause of death. No one recently has mentioned the possibility of atresia of the posterior nares in such cases. The explanations usually offered by pathologists (Arey and Dent[2]) have about them an air of mystery and diagnostic confusion, leaving one with the conclusion that the real cause of death was not found. Naturally, there is always a pathologic cause of death, and it is impossible to make a diagnosis of any condition if an incomplete physical examination is conducted. Mechanical suffocation in every instance is the ultimate cause of death, but it is never a contributory cause. At one time the chief contributory cause was thought to be the covering of the infant's face with blankets or other bedclothes. This theory has since been discarded, and rightly so, because it never was or could have been a factor. A newborn infant unable to get air to inflate its lungs dies of suffocation, with atelectasis as the ultimate cause. Since atelectasis is observed commonly at autopsy, with no explainable reason in many instances, its presence should lead the pathologist to investigate the posterior for bil eral atresia. This condi re

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could be the contributory cause of death.

Werne and Garrow[3] have shown a great deal of interest in the analysis and potential solution of the problem of suffocation in infants, for which they deserve much credit. Their excellent article[3a] should be read to be appreciated. Statements such as the following appear throughout their article: "It is difficult to explain at autopsy the infant mortality of a number of stillbirths and neonatal deaths. An admission is made that if no reasonable cause of death is found by the Medical Examiner, it is not often received with the equanimity that such intellectual honesty deserves. ere is no other group of cases in which proportion of negative postmortem ings is as high as among fetal deaths." om the foregoing statements I suspect that it is in these cases that atresia of the posterior nares might have been discovered if the posterior nares had only been examined. Werne and Garrow[3] have discussed the same problem in other articles, without coming to any definite conclusion.

In 1829, Otto[4] first recognized and described bilateral atresia of the posterior nares, observed at autopsy in an infant whose death was attributed to asphyxia neonatorum. Ronaldson,[5] in 1881, confirmed this observation. Fraser,[6] in 1910, obtained a specimen *en bloc* at autopsy, showing atresia of the right posterior nares. Since then, very little has been heard about this relation.

In a talk given before the American Academy of Forensic Sciences, Werne[7] said, "Some doctors and pathologists conclude that a baby has died of suffocation when no other cause of death is apparent." He criticized the diagnosis of suffocation made by other pathologists and advanced the idea that there is absolutely no justification for a diagnosis of suffocation, as it can only lead to a feeling of guilt on the part of the parents. It would seem to me that it is more important to locate the cause of death than it is to allay the parents' feeling of guilt with a false diagnosis. Should not the onus of guilt be removed from the pathologist? It is also my conviction that many pathologic conditions of the chest, observed microscopically and reported by the pathologist, are rather the terminal than the primary cause of death. A fulminating respiratory disease may be present in some cases, but it is difficult to believe that it is present in all of the many cases reported, especially when one considers the possibility of sudden death, in an apparently healthy infant, because of unrecognized atresia of the posterior nares.

Statistics on infant mortality never tabulate atresia of the posterior nares as a cause of infant suffocation; one would think such a condition did not exist. The compilation of such statistics should be corrected to include this anomaly as one of the causes of infant mortality. The statistics are lacking in this respect only because the pathologists do not examine the nose for this condition. Vital statistics are made by the clinician and the pathologist. In a bulletin issued by the City of New York Department of Health in 1953, Erhardt[8] stated that 39 more infant deaths fell into the "all other causes" category. This increase is largely composed of deaths attributed to symptomless and ill-defined causes. Experience indicates that most of them will eventually be classified as accidental. If this is true, Erhardt said, the accidents involving infants more than 1 month old will show a substantial increase in the final figures. Such a statement is highly significant. There would be no reason for such a classification if the search for the cause of death is extended to some heretofore unexplored areas. My suspicion is very strong that these infants, if examined, will have atresia of the posterior nares, as described by Otto[4] and Ronaldson.[5] Confirmation of their work would clear up a good deal of the current vagueness in statistical classification and tabulation. The "all other causes" or "cause unknown" category could possibly be eliminated.

What is the importance of all this? It is not commonly known or realized that an infant up to about 5 months of age will not open its mouth to breathe if it cannot breathe through its nose. The reason for this is not at all understood. It may be, however, that no voluntary associated reflex is developed until about that age. This little known fact is the reason infants suffocate. Thomson[9] stated that it is natural for the newborn to breathe only through the nose. A case of bilateral atresia in a newborn infant was reported by Richardson[10] who stated that he was able to keep the child alive by keeping the lips apart, with the aid of assistants who helped him maintain mouth breathing. Wilkerson and Coyce,[11] reporting the case of a newborn infant, with complete bilateral atresia of the posterior nares, concluded that in such a case it is necessary to life that the child's mouth be kept open.

That an infant who cannot breathe through its nose will usually not open its mouth to breathe can be easily demonstrated by anyone in the nursery, by carefully and gently pinching together the nostrils of a newborn infant, preferably after it has had its bottle, and when it is resting quietly and not crying. This prevents air from entering the nose and simulates complete bilateral nasal obstruction, such as would be present in a case of bilateral atresia of the posterior nares. In a number of these tests, but not necessarily in all, the infant will begin to tighten and draw in its lips in an attempt at forced nasal breathing, but it will not open its mouth to breathe. Instead, it will begin to struggle for air, turn red in the face and manifest signs of impending asphyxia.

The results of such an experiment should serve as conclusive evidence that infants born with bilateral atresia of the posterior nares will die of suffocation at birth if the condition is not immediately recognized and treated. The same is true of an infant with unilateral atresia of the posterior nares when it is placed on its abdomen in its crib or carriage, with its head turned to one side, so that the normal or clear side of the nose is buried in the pillow or mattress. The mysterious and unexplained deaths of apparently healthy infants found dead in their cribs or carriages are probably due to this cause. Such deaths usually occur in infants up to about 5 months of age, possibly because, up to that age, a normal infant is ordinarily unable to turn its head sufficiently away from the pillow to enable it to breathe through the nose. However, unilateral atresia of the posterior nares occasionally occurs in an older child or an adult, which means that persons with unilateral atresia do not necessarily die. One would probably encounter more cases of unilateral atresia than one does now, if all of the patients survived past infancy.

These sudden deaths of infants should not be confused with death due to a fulminating infection, in the lungs or elsewhere, which is something entirely different. Nevertheless, infants up to about 5 months of age can die of suffocation, under favoring conditions, if unilateral atresia of the posterior nares is present.

It is axiomatic that the most important factor in the prevention of asphyxia neonatorum is to establish a clear airway quickly. Yet very few realize today, that mucus in the nasal passages is not entirely responsible for the nasal obstruction that prevents air from passing through the nose into the lungs.

Congenital bilateral atresia of the posterior nares in infants up to about 5 months of age is seldom, if at all, thought of by most obstetricians, pediatricians, anesthetists, pathologists, or even public health authorities, as a possible cause of asphyxia neonatorum.

Papers have been published (Pfingst;[12] Colver;[13] Klaff;[14] Boyd;[15] Ersner;[16]) which describe operations on older persons with bilateral atresia of the posterior nares. My personal understanding of this condition, however, does not permit me to reconcile survival beyond infancy with the existence of bilateral atresia of the posterior nares. Most children with this condition die at birth if it is not recognized and treated. It is possib that
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able to survive. Another explanation may be that the atresia is not complete at birth, but only partial, so that sufficient air is breathed to maintain life.

In all cases of asphyxia neonatorum and in all cases of infants found dead in their crib or carriages, the pathologist should investigate the posterior nares at autopsy. Unfortunately, few if any pathologists are trained to do so. The only approach that was formerly used was to remove the nasal pyramid and in this manner inspect the interior of the nose. This procedure is now never used, because the law does not permit the facial features to be mutilated; as a result, the proper investigation of the nose was abandoned. The pathologist at autopsy can, however, obtain a specimen of the posterior nares, *en bloc,* for examination. The specimen can easily be obtained by way of the mouth or through the anterior cranial fossa, without in any way mutilating the face. It should include the posterior half of the hard palate with the soft palate attached, extending it to the lateral walls of the nose, including the roof of the nose or the floor of the anterior cranial fossa. If the investigation of the nose were carried out routinely in this manner in all cases in which there is no other pathologic change, it is very likely that more cases of atresia of the posterior nares would be recorded.

Other interesting articles on this subject have been written. Medovy and Beckman[17] wrote an excellent paper, reporting several cases in which openings were made in the posterior nares as a life-saving measure. Cohen and Witchell[18] had therapeutic difficulties in a case of a bilateral choanal atresia, arriving at the diagnosis only on postmortem examination. Emmett and Rosenthal[19] reported vital statistics of the United States as follows: 1,568 infant deaths in 1948 were classified as due to accidental suffocation; 5,315 deaths of children under 1 year of age were ascribed to "asphyxia, cause not specified," and several hundred infant deaths were ascribed to "status thymicolymphaticus." These figures are appalling. Emmett and Rosenthal, however, disagreed with this statistical classification, emphasizing the fact that a careful and complete postmortem examination should be made. No thought, however, of including the posterior nares in the examination at autopsy is mentioned. Abramson[20] reported on 139 infants under 1 year of age whose deaths in New York City from January 1939 to December 1943 were attributed to "accidental mechanical suffocation." He did not arrive at any helpful conclusion. Farber[21] expressed the opinion that more careful postmortem and experimental studies should be productive of physiologic and pathologic data to clarify the problem. He, like many others, was at a loss to explain asphyxial deaths. This situation still exists today. Potter and Adair[22] in their book Fetal Neonatal Deaths, made no mention of atresia of the posterior nares. Instead, they stated that, if the cause of death cannot be found, it is just as important to establish the normal character of the organs as it is to discover pathologic change. Donlon[23] presented an excellent and complete treatise on resuscitation of the newborn.

Enough evidence has now been presented to emphasize the importance of this forgotten area of investigation. What can be done to correct the situation?

*Diagnosis.*—1. *Bilateral Atresia of the Posterior Nares:* In all cases of asphyxia neonatorum, bilateral atresia of the posterior nares should be kept in mind as a possibility.

2. *Unilateral Atresia of the Posterior Nares:* The presence of unilateral atresia should always be considered in an infant up to about 5 months of age when there is a history of undue difficulty in breathing while nursing. Suspected unilateral atresia in the young infant can easily be recognized clinically by closing off each nostril separately, with the finger when the child's mouth is closed, and then watching the reaction for signs of suffocation. If the mouth remains closed and no reaction follows this procedure, both nostrils are evidently clear and patent. If, however, signs of suffocation become manifest when one nostril is closed off, the opposite

side of the nose should be suspected of harboring atresia of the posterior naris. This can be confirmed or disproved by passing a probe or a catheter through the nostril on the suspected side after a topical anesthetic and shrinking agent has been applied to the nasal mucous membrane. Lipiodol roentgen studies will also aid in diagnosis.

In the older child the posterior nares should be checked routinely, with the finger in the nasopharynx at operation, in every case of disease of the tonsils and adenoids. In this manner, atresia of the posterior nares may occasionally be discovered, accounting for a history of unrecognized nasal obstruction.

At autopsy, let me repeat, the pathologist should always examine the posterior nares in all cases of asphyxia neonatorum, as well as in all cases of suffocation in infants up to 5 months of age, especially where no other pathologic change can be discovered.

*Treatment.*—It is interesting to note that various articles[24] on the diagnosis, prevention and treatment of asphyxia neonatorum never mention atresia of the posterior nares as a possibility.

*Bilateral Atresia of the Posterior Nares:* In every case of asphyxia neonatorum due to bilateral atresia of the posterior nares, treatment should be instituted immediately at birth. Atresia in infants is probably membranous, and the membranes should be easily perforated. To prevent asphyxia in the newborn, the following routine should be carried out. Immediately, before anything else is done, open the infant's mouth and keep it open, to assure an adequate airway through this channel. When this has been done, it is not sufficient merely to aspirate the mucus from the nose with a catheter to determine whether or not it is clear; one must go a step further by passing the catheter through each nostril until it reaches the pharynx. Then and only then can one be certain that no nasal mechanical obstruction is present. However, when the catheter is passed into the nose and resistance is encountered to its continued passage, the tendency has been to withdraw the catheter without proceeding any further, for fear that the delicate nasal mucous membrane might be injured. Whenever such resistance to the passage of the catheter is met, and assuming that the atresia is membranous, the catheter should then be deliberately forced through the membrane into the pharynx, regardless of any local damage or trauma, and allowed to remain there for four to six weeks. This procedure can be facilitated by making a crucial incision in the membrane with an otic paracentesis knife before passing the catheter through it, on each side. The life that can be saved by such a procedure is more important than any amount of trauma that may be involved. As a matter of fact, local trauma is of no consequence and has no practical significance. When the area of atresia is bony, a curet is used to perforate it, after which a piece of rubber tubing is placed through it into the nasopharynx. For removal of the rubber tubing from each nostril, the technic of decanulization after a tracheotomy should be employed, as follows: After about four weeks, the rubber tubing should first be removed from one side only. If after another week it is apparent that the amount of air coming through that nostril is diminishing, the tubing should be replaced and left in for a few more weeks; otherwise it may be left out. Should there be no difficulty in breathing, the catheter or tubing may be removed from the other nostril. The infant, nevertheless, should always be carefully watched for signs of closure of the atresial opening, as manifested by difficulty in breathing.

Mechanical respirators or other resuscitating machines are of no value whatsoever if bilateral atresia of the posterior nares is present, unless they are used with the infant's mouth kept open.

*Unilateral Atresia of the Posterior Nares:* In cases of established unilateral atresia of the posterior naris, one should avoid placing the infant upon its abdomen. It is necessary to be certain that the clear side of the nose is free from any obstruction.

When the patient is about 15 years old or older, surgical correction of the atresia can be contemplated. The technic described by me[25] for this correction is the only one that will create a permanently natural opening. The operation is simple to perform and is nondestructive to the surrounding nasal structures; moreover, it is surgically, anatomically and physiologically correct in every way.

## SUMMARY

Atresia of the posterior nares, bilateral and unilateral, is presented as a problem to be dealt and reckoned with by the profession.

The diagnosis and treatment of bilateral atresia of the posterior nares, is discussed, as is the unilateral type of the same condition.

Evidence demonstrating the relation between congenital atresia of the posterior nares and asphyxia is also presented.

The author explains why infants with bilateral atresia of the posterior nares will die at birth if this condition is not recognized. Infants up to about 5 months of age with unilateral atresia of the posterior nares will die of suffocation if the clear nostril is completely obstructed when buried in a pillow.

A suggestion is made that the pathologist include examination of the posterior nares at autopsy in all cases of asphyxia neonatorum, as well as in all cases of mysterious death from suffocation in infants up to about 5 months of age. A suggestion is also made that the pathologist differentiate between the terminal microscopic pathologic changes and the actual cause of death in these cases. It is emphasized that the obstetrician, pediatrician and anesthetist should keep in mind the possibility of this anomaly in all cases of asphyxia neonatorum. Statistical agencies are advised to include it in their tabulation, under "causes of infant deaths by suffocation."

It is suggested that the medical profession do further investigation and research on this subject.

The author's presentation is based primarily upon the work reported by Otto and Ronaldson and upon his own conviction that atresia of the posterior nares can be responsible for asphyxial deaths among infants in many cases.

## CONCLUSION

This paper is presented to stimulate further research interest in the causes of infant suffocation. Basically, there is a great deal of logic in its implications. It should therefore be given serious attention by pathologists, who have heretofore omitted the posterior nares in their postmortem examinations. The relation of atresia of the posterior nares to infant death by suffocation, if properly understood, will go far to clarify many cases of asphyxia neonatorum and of infants found dead in their cribs or carriages. This possibility, apparently, has been almost completely forgotten.

Again, the pathologist should include the posterior nares in his postmortem examination in all cases in which no other cause of death is discoverable. The clinician should also eliminate the posterior nares as a cause of suffocation. With such cooperation it is likely that the lives of many infants could be saved.

When this relation has been reestablished the statistician should include atresia of the posterior nares in his tabulations among the causes of suffocation.

The obstetrician, the pediatrician and the pathologist are equally called upon to give this possibility their serious attention.

It is important to establish that the posterior nares are patent before instituting any measures of resuscitation. If an infant with bilateral atresia of the posterior nares could open its mouth to breathe, it would never suffocate.

## RÉSUMÉ

L'atrésie uni- et bilatérale des narines est présentée comme un problème à prendre en considération.

Discussion du diagnostic et du traitement.

L'auteur présente également une preuve de la relation entre une anomalie congénitale, l'atrésie des narines, et l'asphyxie. Il explique pourquoi les enfants atteints d'atrésie bilatérale des narines meurent à naissance si cet état n'est pas reconnu.

L'auteur propose que le pathologiste n'omette pas, au moment de l'autopsie, l'examen des narines postérieurs, dans tous les cas d'asphyxie chez les nouveauxnés, que dans tous les cas de décès mystérieux par asphyxie d'enfants jusqu'à l'âge de 5 mois.

Il propose aussi que le pathologiste différencie les modifications pathologiques terminales et la cause primaire de la mort dans ces cas.

Il souligne que l'obstétricien, le pédiâtre et l'anesthésiste devraient penser à la présence possible d'une atrésie bilatérales des narines dans tous les cas d'asphyxie de nouveauxnés. Il conseille aux agences de statistiques d'ajouter à leurs graphiques l'atrésie des narines postérieurs sous le titre: "Nouveaux-nés décédés par asphyxie."

Il suggère que la profession médicale fasse des investigations plus poussées dans ce domaine.

Le rapport de l'auteur est basé sur le travail de Otto and Ronaldson, ainsi que sur sa propre conviction que l'atrésie des narines peut être à l'origine de l'asphyxie des nouveaux-nés dans un grand nombre de cas.

## ZUSAMMENFASSUNG

Der angeborene einseitige oder doppelseitige Verschluss der hinteren Nasenöffnungen wird als ein Problem dargestellt, mit dessen Vorkommen der Arzt zu rechnen hat.

Die Diagnose und Behandlung der einseitigen und doppelseitigen Form der Erkrankung wird erörtert.

Es wird ferner nachgewiesen, dass Beziehungen zwischen einer angeborenen Anomalie wie dem Verschluss der hinteren Nasenöffnungen und Erstickung bestehen. Der Verfasser erklärt, warum Neugeborene mit Verschluss der hinteren Nasenöffnungen bei der Geburt sterben, wenn die Erkrankung unerkannt bleibt. Säuglinge bis zum Alter von etwa fünf Monaten mit einseitigem Verschluss der hinteren Nasenöffnungen können ersticken, wenn die freie Nasenhälfte bei Bauchlage des Kindes in einem Kissen begraben ist.

Es wird der Vorschlag gemacht, dass Pathologen bei der Obduktion von Neugeborenen oder von Säuglingen im Alter bis zu fünf Monaten, die einen unerklärten Erstickungstod gestorben sind, die Untersuchung auf die hinteren Nasengänge ausdehnen. Ferner sollte der Pathologe in solchen Fällen zwischen den terminalen mikroskopischen Krankheitsveränderungen und der primären Todesursache unterscheiden.

Es wird betont, dass der Geburtshelfer, der Kinderarzt und der Narkotiseur an die Möglichkeit eines doppelseitigen Verschlusses der hinteren Nasengänge in allen Fällen von Erstickung eines Neugeborenen denken müssen. Statistische Aemter werden angeregt, in ihre Formulare unter der Rubrik "Säuglingstod durch Erstickung" die Diagnose Verschluss der hinteren Nasenöffnungen aufzunehmen.

Die Aerzteschaft wird zu weiterer Forschungsarbeit auf diesem Gebiet aufgefordert.

Die Arbeit stützt sich im wesentlichen auf die Berichte von Otto und Ronaldson und auf die eigene Ueberzeugung des Verfassers, dass der hintere Nasenhöhlenverschluss für viele Fälle von Säuglingserstickung verantwortlich ist.

## RESUMEN

Se presenta la atresia de las narinas posteriores, bilateral ó unilateral, como un problema que debe tratarse y considerarse por la profesión.

Se discute el diagnóstico y tratamiento de la atresia bilateral de las narinas posteriores junto con la atresia unilateral.

Se presenta también la evidencia que demuestra la relación entre una anomalía

congénita, la atresia de las narinas posteriores y la asfixia.

El autor explica porqué muchos de los niños con atresia bilateral de las narinas posteriores mueren al nacer si este padecimiento no es reconocido. Los niños hasta cinco meses de edad con atresia unilateral de las narinas posteriores pueden morir de sofocación si la narina permeable es obstruída completamente por una almohada, permaneciendo con la cara hacia abajo.

Se hace la sugerencia de que el anatomopatólogo incluya el examen de las narinas posteriores en la autopsia de todos los casos de asfixia neonatorum, así como en todos los casos de niños hasta cinco meses de edad que han muerto misteriosamente de sofocación. Se hace también la sugerencia de que el anatomopatólogo diferencía entres los cambios patológicos microscópicos terminales y la causa primaria de la muerte en estos casos.

Se hace notar que el tocólogo, pediatra y anestesista deben tener en cuenta la posibilidad de la presencia de una atresia bilateral de las narinas posteriores en todos los casos de asfixia neonatorum. Se aconseja a las agencias de estadística el incluír la atresia de las narinas posteriores en su tabulación bajo el título de "niños muertos por sofocación."

Se sugiere que la profesión médica realice investigaciones posteriores sobre el tema.

La presentación del autor se basa primariamente sobre el trabajo comunicado por Otto y Ronaldson y sobre su propia convicción de que la atresia de las narinas posteriores puede ser responsable de la asfixia de los niños en muchos de los casos.

## RIASSUNTO

Il problema dell'atresia, mono– e bilaterale, delle fosse nasali posteriore deve essere ben conosciuto da coloro che si danno all'esercizio professionale. Vengono discusse diagnosi e terapia dell'atresia mono– e bilaterale delle fosse nasali posteriori. Vengono anche presentati dati che dimostrano la relazione che corre fra una anomalia congenita, lo stato patologico in questione e l'asfissia. L'autore spiega perchè un neonato portatore di un'atresia bilaterale delle fosse nasali posteriori, possa morire all'atto stesso della nascita qualora lo stato patologico non venga diagnosticato. Infatti sui 5 mesi d'età con atresia monolaterale delle fosse nasali posteriori possono morire soffocati se vengano posti bocconi su un guanciale e la narice libera, di conseguenza, si occluda. Si ritiene *pertanto necessario che l'anatomo-patologo* esamini anche le fosse nasali posteriori nel corso di autopsie di neonati morti d'asfissia e di lattanti sui 5 mesi morti nispiegabilmente per soffocazione. Si raccomanda ad ostetrici, pediatri ed anestesisti di tener presente la possibilità dell'esistenza di un'atresia mono– o bilaterale delle fosse nasali posteriori in ogni caso di asfissia dei neonati. E si consigliano gli Istituti di statistica di includere l'atresia delle fosse nasali posteriori fra le "cause di morte dei neonati per soffocazione." Si ritengono utili ulteriori studi e ricerche su tale argomento. Il lavoro dell'autore si basa principalmente sull'esperienza di Otto e Ronaldson, ed anche sulla propria convinzione che un gran numero di casi asfissia dei neonati, sia dovuto all'tresia delle fosse nasali posteriori.

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* * *

For guidance we have the advice of St. Paul: to prove all things and hold fast that which is good. And the spirit of this counsel should pervade our attitude to surgery; the spirit, and not the letter, for if we try all things, we will do a great deal of harm to our patients in finding that which is good. Ingenuity, courage, and unconventionality are admirable qualities in a surgeon so long as they are not practised on others. Therefore, before we try any new idea, we must first ask ourselves: 'Is it reasonable? Has it a scientific basis? Is it safe enough to try on a patient, or should I first try it on myself, or in the laboratory? Has it, or anything similar, been done before, from which I can judge the chances of success or failure? If it has failed in the past, was failure due to a fault inherent in the method, or because some factor making for safety or success was unknown to the man who carried it out?'

—*Ogilvie*

# Incidence of Acute Appendicitis

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SEVERAL clinicians in the United States have the impression that the incidence of acute appendicitis is on the wane, since fewer cases have been encountered by these practitioners. In order to determine whether this impression is true, a study was made of the number of cases of acute appendicitis created by operation at Mount Sinai Hospital in Chicago during the past fourteen years. Mount Sinai is a general medical and surgical hospital with approximately 300 beds, having several surgeons on the staff.

The category "acute appendicitis" was taken to include acute catarrhal, suppurative and gangrenous appendicitis, with and without perforation. The number of operative cases of acute appendicitis was compared to the total number of patients admitted and the resultant percentages determined. The average percentage over the fourteen-year period was 1.32. The number of admissions to the hospital had risen during the period, whereas the number of cases of operative acute appendicitis did not. Relatively, there appears to be a gradual percentage decrease of operations for appendicitis, particularly in the period from 1940 through 1949. In 1939, 1940 and 1941 there was a higher relative incidence than in other years. In 1944, 1945 and 1951 there was a percentile rise above the average. These results are shown in Table 1.

The number of cases of acute appendicitis was then compared with the total number of major general surgical operations performed each year at Mount Sinai Hospital. There was an overall increase in the number of major general surgical operations except for the years 1944, 1945 and 1946, but this is what one would expect with the increase in admissions and the broadened scope of surgical treatment. The average percentage of the major general surgical operations for acutely diseased appendices was 5.80. In 1945 and 1951 there was a slight rise above the average. As compared to the number of general surgical operations performed, it appears that the number of cases of acute appendicitis treated by operation is not increasing proportionately; in fact, the relative percentile incidence of acute appendicitis is gradually decreasing (Table 2). Each year since 1939, a greater percentage of the total number of appendices removed (including both pathologic appendices and those removed incidentally in some other procedure) have been acutely diseased, substantial elevations occurring from 1950 forward.

## COMMENT

The appendix is a nonsterile organ having the same flora as the surrounding

TABLE 1.—*Number of Cases of Acute Appendicitis, Surgically Treated, as Against the Total Number of Admissions*

| *Year* | *Total Admissions* | *Number of Cases of Acute Appendicitis* | *Percentage of Admissions* |
|---|---|---|---|
| 1939 | 7,268 | 130 | 1.79 |
| 1940 | 7,052 | 139 | 1.97 |
| 1941 | 7,343 | 129 | 1.76 |
| 1942 | 9,013 | 110 | 1.22 |
| 1943 | 8,741 | 101 | 1.16 |
| 1944 | 9,206 | 139 | 1.51 |
| 1945 | 8,284 | 124 | 1.5 |
| 1946 | 8,838 | 102 | 1.15 |
| 1947 | 10,206 | 120 | 1.17 |
| 1948 | 10,984 | 119 | 1.08 |
| 1949 | 12,032 | 123 | 1.02 |
| 1950 | 11,953 | 135 | 1.13 |
| 1951 | 12,797 | 192 | 1.5 |
| 1952 | 13,086 | 148 | 1.13 |
| Average | 9,772 | 129 | 1.32 |

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From the Departments of Surgery, Chicago Medical School and Mount Sinai Hospital, Chicago, Illinois.

Submitted for publication April 13, 1954.

TABLE 2.—*Number of Cases of Acute Appendicitis, Surgically Treated, Compared with Number of Major General Surgical Operations*

| *Year* | *Number of Major General Surgical Operations* | *Total Number of Acute Appendicitis* | *Percentage of Major General Surgical Operations* |
|---|---|---|---|
| 1939 | 1,393 | 130 | 9.33 |
| 1940 | 1,445 | 139 | 9.62 |
| 1941 | 1,854 | 129 | 6.96 |
| 1942 | 1,945 | 110 | 5.66 |
| 1943 | 2,032 | 101 | 4.97 |
| 1944 | 2,326 | 139 | 5.98 |
| 1945 | 1,907 | 124 | 6.5 |
| 1946 | 1,985 | 102 | 5.14 |
| 1947 | 2,131 | 120 | 5.63 |
| 1948 | 2,398 | 119 | 4.96 |
| 1949 | 2,654 | 123 | 4.63 |
| 1950 | 2,759 | 135 | 4.89 |
| 1951 | 3,125 | 192 | 6.14 |
| 1952 | 3,259 | 148 | 4.54 |
| Average | 2,229 | 129 | 5.80 |

bowel. The normal appendix has peristalsis and secretes mucus. The obstructive theory of initiation of acute appendicitis is well known. Impairment of the blood supply resulting from obstruction, causes loss of oxygen in the tissue, making it prone to bacterial invasion. Since the appendiceal artery is an end artery, this process is not reversible after it has reached a certain point, and if it is not interfered with it may proceed to gangrene.

What factors play a role in the apparent relative decrease in the incidence of acute appendicitis at Mount Sinai Hospital? It is unlikely that the antibiotics and sulfa drugs prevent bacterial invasion after obstruction of the appendiceal lumen has occurred, because the process of acute appendicitis has been shown to continue even when the patient is being given penicillin. Good diets and dietary education may enhance physical vitality, with a resultant decrease in spasm and better tonus of the bowel and blood vessels. The cause is not known. Perhaps several factors combined may act as a hidden prophylactic agent. In our opinion, diagnostic measures have not changed or improved during the past fourteen years, so far as this disease is concerned. The percentage of acutely diseased appendices removed, as compared to the total number of appendices removed, having shown substantial elevations during the past three years, may indicate that patients with acute appendicitis are being operated on earlier in the course of the disease, perhaps because the patient is better "educated" than formerly and seeks his doctor earlier.

## SUMMARY

The cases of acute appendicitis treated by operation at Mount Sinai Hospital in Chicago during the past fourteen years (1939-1952) have been studied and are compared with the total admissions, and the total number of major general surgical operations. The latter have increased, but the number of operative patients with acute appendicitis has not increased proportionately. An increasing percentage of all appendices removed (pathologic and incidental) are acutely diseased, this percentage having been substantially elevated during the past three years.

## CONCLUSIONS

1. During the period 1939-1952 at Mount Sinai Hospital in Chicago, the number of admissions and major general surgical operations has risen, but the number of acutely diseased appendices removed has not.
2. The cause of this relative decrease in incidence is unknown.

## RESUMEN

Se estudian y comparan con el total de admisiones y el número de operaciones mayores los casos de apendicítis aguda tratados por operacíon en el Hospital Monte Sinaí de Chicago durante los últimos catorce años (1939-1952), habiendo aumentado el número de operaciones sin que el número de pacientes con apendicitis aguda haya aumentado proporcionalmente. Un porcentaje creciente de todos los apéndices extirpados (patológica é incidentalmente) se encontraron agudamente afectados, este porcentaje ha aumentado substancialmente durante los últimos tres años.

### ZUSAMMENFASSUNG

Es liegt eine Analyse der in den letzten 14 Jahren (1939-1952) im Mount-Sinai-Hospital in Chicago wegen akuter Blinddarmentzündung operierten Fälle vor; das Verhältnis des Materials zur Zahl der Gesamtaufnahmen und zur Anzahl sämtlicher grösserer chirurgischer Eingriffe wird untersucht. Die Gesamtzahl grösserer chirurgischer Eingriffe lässt eine Zunahme erkennen, mit der das Anwachsen er Zahl von Kranken mit akuter Blinddarmentzündung nicht Schritt gehalten hat. Der Prozentsatz akut erkrankter Wurmfortsätze unter dem Gesamtmaterial aller als krank oder gelegentlich resezierter Blinddärme ist besonders im Laufe der letzten drei Jahre erheblich angestiegen.

### RÉSUMÉ

Les auteurs ont étudié tous les cas d'appendicite aiguë opérés au Mount Sinai Hospital de Chicago durant les 14 dernières années (1939-1952). Statistique par rapport au nombre total des entrées et au nombre total des interventions majeures de chirurgie générale. Ces dernières ont augmenté, mais la courbe des opérations pour appendicite aiguë ne s'est pas élevée dans la même proportion. Le pourcentage des décès après appendicectomie aiguë s'est nettement accru au cours des trois dernières années.

### RIASSUNTO

Studio statistico dei casi di appendicite ricoverati e operati in 14 anni (1939-1952) al Mount Sinai Hospital di Chicago. Il numero di tali casi non è cresciuto proporzionalmente al numero totale dei ricoveri per altre affezioni. Sono aumentate, invece, negli ultimi 3 anni, le forme acute.

The student of surgery must be grounded in a teaching that has the foundation of tradition, or, in other words, the continuous approval of the best minds of many years behind it; only when his feet have been thus firmly planted on the solid rock of accepted doctrine can he advance to greater heights along paths of his own discovery. But the practising surgeon should contemplate change rather than immutability, for in the simmering theories of to-day are crystallizing the orthodoxies of to-morrow. Change is always with us, and it is interesting to look over the period of our own experience and to consider how far surgery has changed in that time, what have been the forces impelling those changes, and in what direction they are likely to lead us in the immediate future.

—*Ogilvie*

# The Vitallium Sphere Prosthesis for Nonunion of the Navicular Bone

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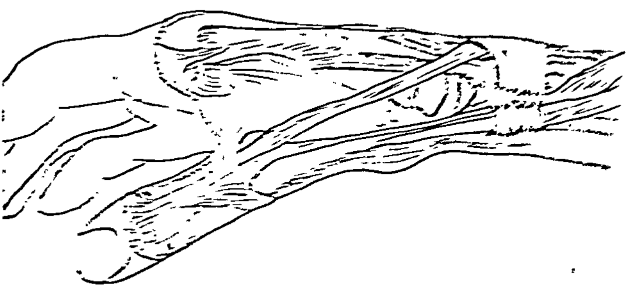
YOUNG men of military age are subject to frequent trauma resulting in fracture of the carpal navicular bone. In a fall on the outstretched hand the radial styloid acts as a chisel to fracture the waist of the bone. Early recognition of the fracture and prolonged immobilization result in union in a large percentage of cases, but all too frequently the fracture is not recognized or is inadequately treated and nonunion develops.

In these cases there is progressive widening of the fracture line, which in some cases appear to be pried apart by the wedge action of the radial styloid. Aseptic necrosis and/or cystic degeneration may supervene. Furthermore, aseptic necrosis is observed occasionally in the distal as well as in the proximal fragment. Over a period of years absorption, collapse, radial deviation and traumatic arthritis occur. This is the fate of untreated nonunion of the navicular bone (Fig. 1).

Prolonged cast immobilization may achieve union in some cases, but this does not preclude the delayed development of aseptic necrosis. Bone grafting of the navicular bone may achieve union, but it usually leaves a painful arthritic wrist. Wrist fusion after a long period in a cast provides a serviceable wrist, but at a sacrifice of some wrist motion. Osteotomy alone may relieve pain, but it produces, uniformly, a weak wrist, because the stabilizing wrist tendons are left out of equilibrium. To prevent this weakness and to maintain motion, a vitallium sphere prosthesis (Table 1) was developed by [illegible] as a replacement.

With a tourniquet applied to the brachium the hand is operated on under [illegible] condition. A curved incision is made from Lister's tubercle, radially over the



[illegible]

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Read at the [illegible] of the American [illegible] Association, [illegible] California, [illegible]. Submitted for publication [illegible].

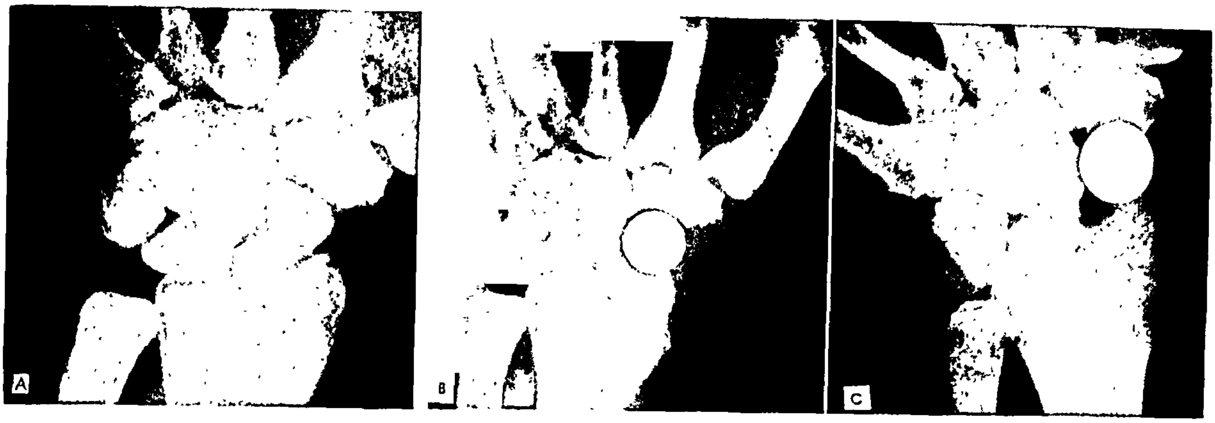

Fig. 3 (Case 3).—*A*, nonunion, eight months old. *B*, postoperative roentgenogram. *C*, film taken three and one-half years after the operation. Excellent functional result; no disability.

TABLE 1.—*Methods of Treatment and Their Results*

1. Casting—prolonged morbidity
2. Bone peg—union? painful wrist
3. Wrist fusion—stiff wrist
4. Scaphoidectomy—weak wrist
5. *Vitallium sphere implant—good function, short* period of disability

styloid process and distally over the "snuffbox." A flap of joint capsule is detached from the radius and reflected distally. The navicular bone is identified lying adjacent to the radial styloid. After the multiple ligamentous attachments of the navicular bone have been dissected free, the bone is removed. Into its cavity a vitallium sphere is inserted, the size being determined by trial. Spheres with diameters of 12, 14 and 16 mm. are available. When a snug fit is obtained, a sphere one size smaller is used. The capsule is sutured over the sphere, and the wound is closed. An elastic bandage is used for a dressing. No cast is applied. Wrist motion is begun early, as after a ganglion excision. The patient may leave the hospital in a few days and is able to return to work within three or four weeks (Fig. 2).

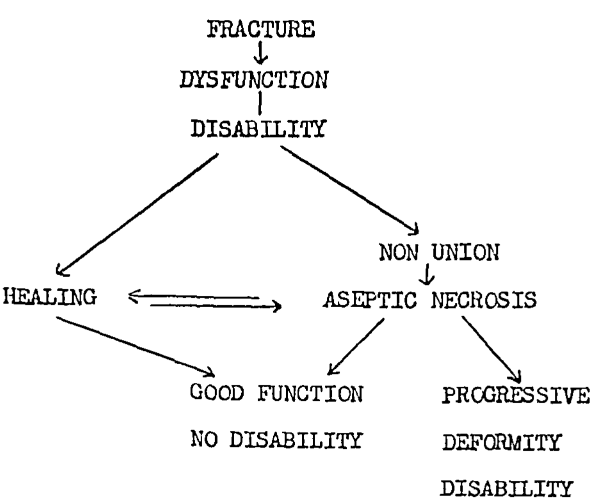

Fig. 1.—Explanatory diagram (see text).

A review of 30 surgical cases within the last four years reveals that the average age of the fracture at the time of operation was two and one-half years and that the average period of postoperative disability was three and one-half weeks. One patient, with associated reflex sympathetic dystrophy, was improved by the operation combined with stellate block. In 1 patient who was followed up for three and one-half years, concurrent gouty arthritis developed in the knee, but this did not affect the good function of the wrist. The average patient showed normal range of painless motion within one month. None were made worse by the operation, and no surgical infections occurred (Table 2).

The indications for this operation are:

TABLE 2.—*Review of 30 Cases*

Average fracture age—2½ years
Average period of postoperative disability—3½ weeks
Complications:
1. Dislocation (part of navicular remained)
2. Reflex sympathetic dystrophy (improved after sphere arthroplasty)
3. Gout (incidental)

Conditions made worse—none
Infections—none

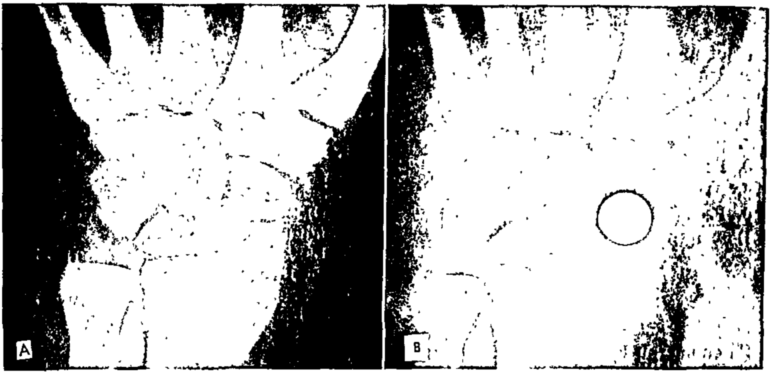

Fig. 4 (Case 4).—*A*, cystic degeneration two years old. Note wedge action of radial styloid. *B*, postoperative condition. No disability.

(1) aseptic necrosis; (2) cystic degeneration; (3) fracture malunion; (4) localized traumatic arthritis, and (5) long-standing painful nonunion.

It appears that this procedure has great merit in reducing the disability and morbidity incident to nonunion of the navicular bone and its former treatment, and therefore should be more widely accepted in both military and civilian practice.

## SUMMARY

Indications for use of the vitallium sphere prosthesis in cases of nonunion of the carpal navicular bone are listed. They include (1) aseptic necrosis; (2) cystic degeneration; (3) malunion; (4) localized traumatic arthritis, and (5) long-standing painful nonunion. The technic of insertion of the prosthesis is described.

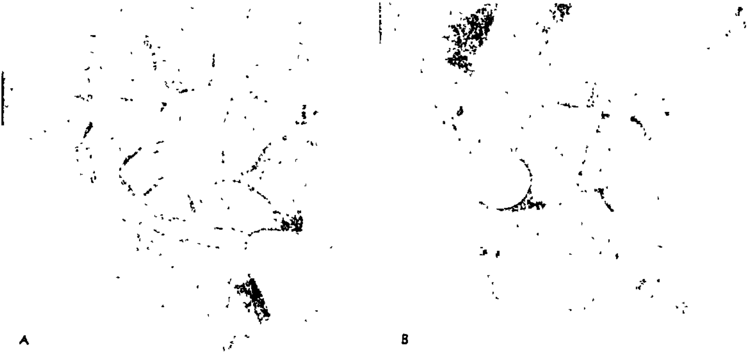

Fig. 5 (Case 5).—*A*, nonunion, aseptic necrosis of distal fragment.
function.

### RÉSUMÉ

L'auteur énumère les indications de la prothèse en vitallium dans les cas de fracture du scaphoïde:

1. Nécrose aseptique
2. Dégénérescence kystique
3. Pseudarthrose
4. Arthrite traumatique localisée
5. Pseudarthrose chronique douloureuse

Description de la technique.

### RESUMEN

Se enumeran los usos de la prótesis esférica de vitalium en los casos de falta de unión del hueso navicular del carpo, comprendiendo: (1) Necrosis aséptica, (2) Degeneración cística, (3) Defecto de unión, (4) Artritis traumática localizada y (5) Falta de unión larga y dolorosa. Se describe la técnica para la colocación de la prótesis.

### ZUSAMMENFASSUNG

Es werden die Indikationen zur Anwendung der kugligen Vitalliumprothese in Fällen von nicht heilenden Verletzungen des Kahnbeins des Handgelenks aufgeführt. Dazu gehören:

1. Aseptische Nekrose.
2. Zystische Entartung.
3. Schlecht verheilte Brüche.
4. Umschriebene traumatische Gelenkentzündung.
5. Lange bestehende schmerzhafte nichtheilende Brüche.

Die Technik der Einsetzung der Prothese wird beschrieben.

### RIASSUNTO

Le indicazioni per l'impiego della sfera di vitallio sono le seguenti: necrosi asettica dell'osso navicolare, degenerazione cistica, difettosa fissazione, artrite traumatic circroscritta, sin dromi dolorose. Viene prescritta la technica di applicazione della protesi.

◆

> Of all our passions, that which is most unknown to ourselves is indolence. Although the injuries it causes are very imperceptible, no other passion is more ardent or more malignant. If we consider attentively its influence we shall see that on every occasion it renders itself master of our sentiments, our interests, and our pleasures; it is the remora which arrests the course of the largest vessels, a calm more dangerous to the most important affairs than rocks or tempests. The repose of indolence is a secret spell of the mind which suspends our most ardent pursuits and our firmest resolves.
>
> —*La Rochefoucauld*

# Section on Ophthalmology and Otorhinolaryngology

PAUL C. CRAIG, M.D., F.A.C.S., F.I.C.S., Editor

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# Repair of Cleft Palate by the Bone Flap Method

## Group Evaluation of Cases

LYNDON A. PEER, M.D., F.A.C.S., F.I.C.S., ROBERT HAGERTY, M.D., F. S. HOFFMEISTER, M.D., D.D.S., AND MICHAEL B. COLLITO, D.D.S.
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IN our Cleft Palate Group at St. Barnabas Hospital, Newark, N. J., we have emphasized the importance of growth studies in an effort to clarify the effect of early cleft palate operations on the development of the facial bone structure. We also tend to use the group method of diagnosis and management for all types of deformities in the field of plastic surgery as well as to harelip and cleft palate.

Our Group consists of eight major departments as follows: Plastic Surgery, Speech Therapy, Psychology, Orthodontia, Dental Rehabilitation, Cephalometrics (for growth studies), Otolaryngology, and Pediatrics. Accessory services include Neurosurgery, Endocrinology, Psychiatry, Orthopedics and other specialties, according to the requirements of individual patients.

Surgery:
  Lyndon A. Peer, M.D., Attending Plastic Surgeon and Group Coordinator. St. Barnabas Hospital

Pediatrics:
  Edward P. Duffy, Jr., M.D., Attending Pediatrician, St. Barnabas Hospital

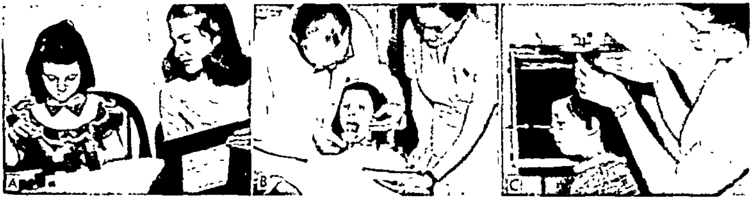

Fig. 1.—*A*, psychology. Intelligence and social maturity determinations are made by individual tests. Mary's intelligence is superior. Social maturity, low average. Recommendations: Stimulate group activities and have parents attend psychological aid sessions at the Center. *B*, orthodontia. Plaster dental casts are made which present details of the anatomy of the teeth, alveolar processes and palate. Recommendations: Early orthodontic management to correct relationship of alveolar bases. Establish ideal occlusion. *C*, cephalometrics. Standardized head plates evaluate growth changes in the facial skeleton. Development is measured from relatively fixed points within the skull and compared with similar measurements taken from the normal. Recommendations: D[illegible] in *the anterio-posterio direction.*

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**Dentistry:**

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**Speech:**

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**Psychology:**

Mrs. Ruth P. Nevius, M.A., Psychologist.

Harold S. Carlson, Ph.D., Upsala College, Consultant

**Social Service:**

Helen McDonald, Director, Social Service Department, St. Barnabas Hospital

Fig. 2.—*A*, complete single harelip deformity associated with Type III cleft palate. *B*, same child at 4 years of age. Lip and palate have been repaired.

All new patients above the age of 3 years with cleft palates are processed throughout the Group and discussed in conference before any operation or other therapy is undertaken. We also recall patients on whom we have operated for cleft palate and send them through the eight departments at yearly intervals. Each case is discussed individually in conference, and treatment is determined by unanimous agreement of the department heads.

This paper contains a preliminary report of our results from the group study of 188 cases of cleft palate treated by operation. In 133 of these cases the bone flap method* of Warren Davis was employed; in 55, other methods were used (von Langenbach or modifications of this procedure).

*Preliminary Summary of Results.—Age*: The age at operation of the 133 patients treated by the bone flap method varied from 1 to 21 years, as follows:

| | |
|---|---|
| 1 year | 11 |
| 2 years | 86 |
| 3 years | 16 |
| 4 years | 4 |
| 5 years | 4 |
| 6 years | 4 |
| 7-21 years | 8 |

*Type of Repair*: In 12 of these cases the bone flap repairs were of Type I, involving only the soft palate; in 39 cases, Type II, with the cleft extending through the hard palate; in 56 cases, Type III, and in 26, Type IV, with bilateral cleft deformities.

*Unintentional Fistulization in Bone Flap Repair*: In 113 cases no fistulas occurred in the palates; in 9 there were small openings that did not affect func-

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*In about two thirds of the cases the repair was done by the senior author (Dr. Peer); in the remaining one third the operations were performed by residents on the Service, using the same technic.

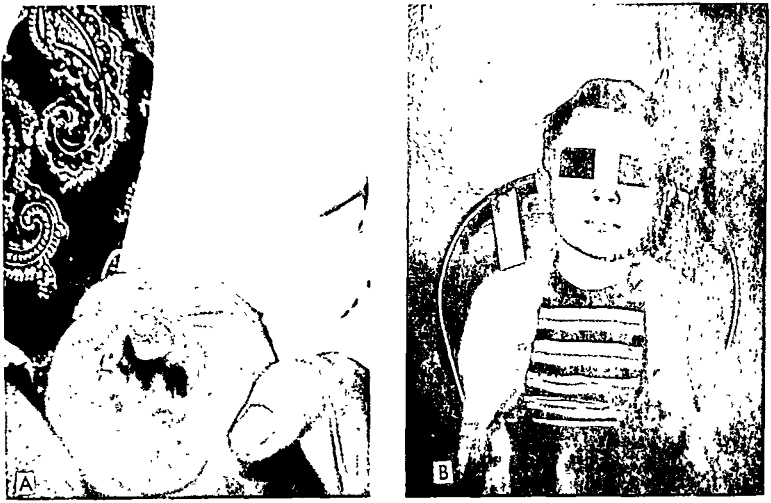


Fig. 3.—*A*, bilateral harelip deformity associated with Type IV cleft palate. *B*, same child at 5 years of age. Lip and palate have been repaired.

tion, and in 11 cases there were moderately large openings. We were unable to establish any relation between the patient's age at operation and the occurrence of fistulas.

*Mobility of Soft Palate*: The soft palates revealed their status as to mobility in the following distribution:

| | |
|---|---|
| Good | 105 |
| Fair | 5 |
| Poor | 13 |
| No reliable evidence | 10 |

We were unable to make any significant correlation between the age at operation and the mobility of the palate.

Lipiodol was sprayed through the nose and roentgen negatives taken with the palate at rest with the patient saying "ah" and with the patient making a sustained "s" sound. The minimum distance between the soft palate and the posterior wall of the pharynx was measured from the roentgen negatives, and this distance was correlated with the degree of nasality and speech distortion.

Our evidence indicates that there is little, if any, nasality when this minimum distance between the soft palate and pharynx is not greater than 1 mm. with the patient making a sustained "s" sound. There is minor nasality when the distance is between 3 and 4 mm. and considerable nasality when it is 4 mm. or more.

The mean distance in our series between the soft palate and the posterior pharyngeal wall was 3.52 mm., with moderate nasality as a mean or average result. In cases at the lower end of the series there was complete absence of nasality (these are the ones we always remember), but in cases at the upper end the nasality was marked.

*Growth of Facial Structure (Preliminary Report)*: We examined 94 patients operated on by the Warren Davis [illegible] flap method and [illegible] by technics. Seven patients not operated on or operated on after the age of 14 were also studied cephalometrically. We used the same measurements that were employed by Brodie and Slaughter.

The 94 bone flap repairs in this group were as follows:

| | |
|---|---|
| Type I | 10 |
| Type II | 22 |
| Type III | 39 |
| Type IV | 22 |
| Type V (midline cleft) | 1 |

About 75 per cent of the 94 patients were between 1 and 2 years of age at the time of operation.

We were surprised to find that the majority of patients in this series showed only minor retardation in the anterior posterior growth of the maxilla, but this was associated with considerable and definite underdevelopment of the mandible in the anterior posterior relationship. Our measurements also demonstrated that in many cases the ramus of the mandible was much shorter than the ramus in patients without the cleft palate deformity. Thus the characteristic picture in our series was that of a relatively stable maxilla associated with a deficient mandible in both the anteroposterior and the vertical direction. Our orthodontist calls this the "pushed-out face," expressing the opinion that it is associated with the original defect rather than due to operative trauma.

A smaller percentage of the patients in our series had the "pushed-in face" type of deformity. In their cases also the maxilla was only slightly underdeveloped but the mandible was so grossly overdeveloped in the anteroposterior dimension that the maxilla appeared recessed.

*Observations in Other Departments.—Psychology*: Our patients with cleft palate, as a group, had a mean intelligence quotient (Stanford-Binet) slightly higher than that of a comparable group of children without the deformity.

Social maturity was low, which we attributed to the effect of imperfect speech and the concomitant harelip deformity on the adjustment of these children with their playmates. In most instances children become aware that they are different after entering school, usually in the first or second grade. This indicates the importance of doing everything possible to have these children at their best regarding speech and appearance before entering school.

*Orthodontia*: Crowding and crossbite are typical malocclusions associated with cleft palate, whether operatively treated

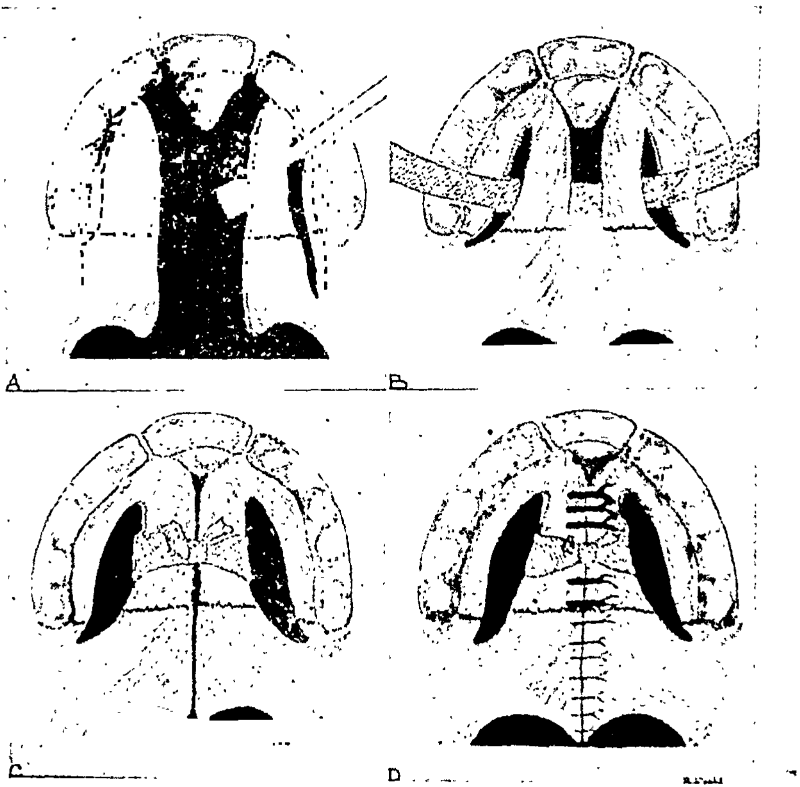
Fig. 4 (*opposite*).—Bone Flap Method of Repair (Warren Davis). A, B and C demonstrated first stage. *A*, drawing represents a wide complete cleft palate associated with a double harelip. The bony palate with its covering oral and nasal mucous membrane has been completely detached with a chisel and the incision extended backward to relax the soft palate. Note "safe" rim of bone, left, along alveolar margin to avoid injuring tooth buds. Dotted line to left demonstrates extent of incision. Wavy horizontal line represents outline of bony palate. *B*, both palatal flaps have been detached and a ribbon of iodoform gauze inserted beneath the flaps. *C*, the iodoform gauze is tied around the palatal flaps and left in place for about five days. The blood supply through the interior and posterior attachments is adequate for proper nourishment of the flaps but it is safer to delay suture of the palate for a period of two weeks. Diagrams A, B and C represent the first stage of the bone flap operation. If the base of the nasal septum is attached to one of the palatal flaps, this junction is separated with a chisel to permit mobilization of the bony palatal flap. *D*, two weeks after the first operation, the opposing margins of the palatal flaps are completely denuded of mucous membrane and the flaps relaxed at the sides so that apposition occurs without tension. Openings are made in the bony palate with a small hand drill and heavy black silk sutures inserted through these openings. When these sutures are tied, the freshened edges of mucous membrane and bone are accurately approximated. Since the sutures are inserted through bone, they do not tend to cut through and fall out. The soft palate is sutured in three layers; the nasal mucous membrane and muscle with triple 0 chromic catgut and the oral mucous membrane with silk. Iodoform gauze is tied around the palatal flaps for complete relaxation. Both the gauze and the sutures are left in place for two weeks. The openings at the sides always granulate and close without surgical assistance. This modified Warren Davis Bone Flap Method of repair provides a palate which is completely covered with oral and nasal mucous membrane. The presence of rigid bone in the front part of the repaired palate prevents anterior contracture and shortening of the palate.

or not. Only 1 patient in 6 is free of malocclusion, which suggests the need for orthodontia regardless of the type of surgical repair.

Neither crowding nor crossbite is related to surgical trauma. Both are related, however, to the type of original defect, since the relative incidence of both deformities increases sharply with the increasing severity of the original defect.

Change of surgical technic cannot be expected to affect the incidence of malocclusion. Age at operation does not affect either its incidence or its severity.

*Hearing*: About 30 per cent of our children with cleft palates demonstrated hearing loss according to audiometer tests. This deafness was usually of the catarrhal type and was associated with a history of repeated colds and the presence of enlarged and often infected adenoids and tonsils.



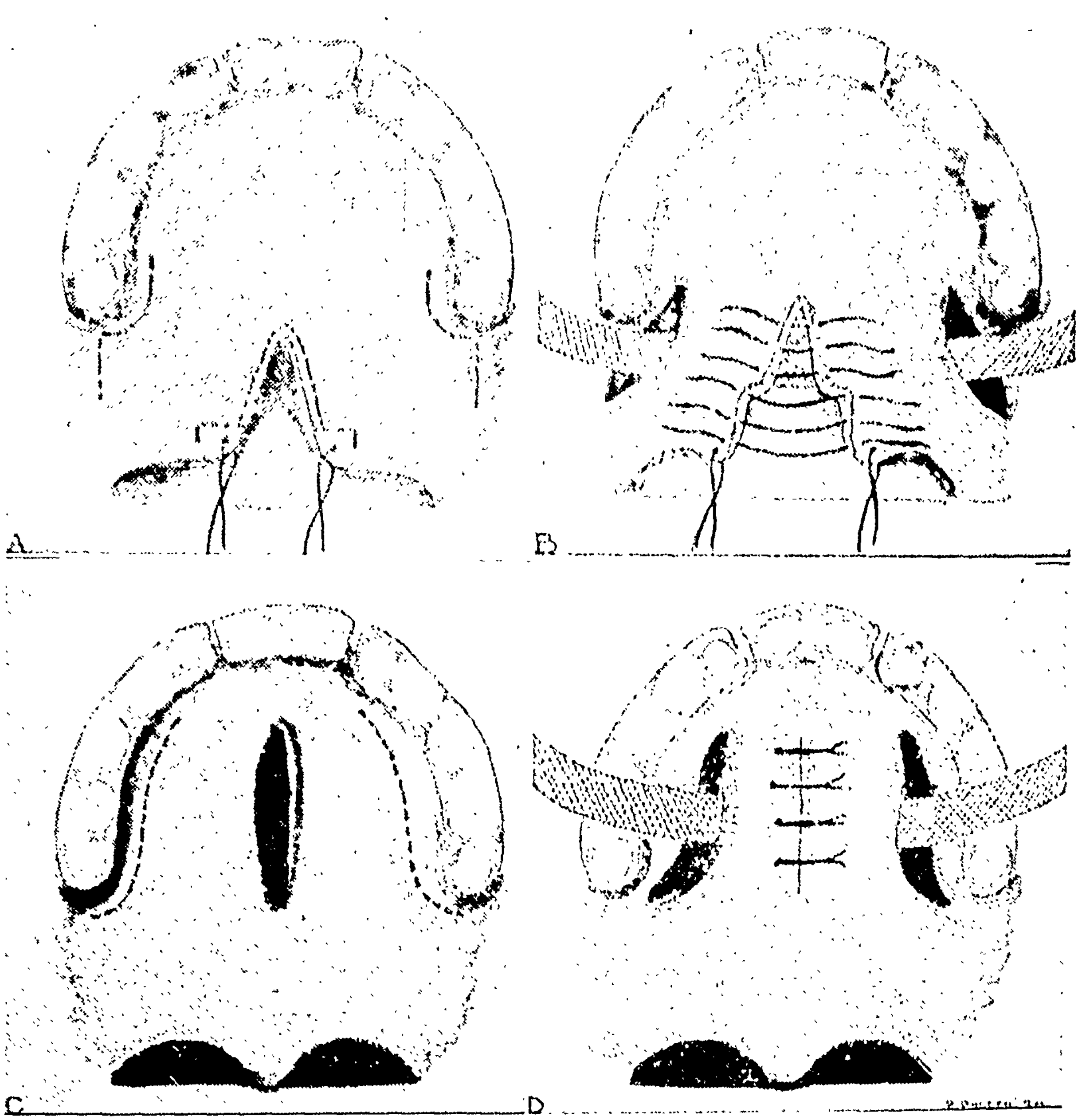


Fig. 5.—Method of repair for old cleft palate which has been operated upon unsuccessfully. *A*, the opposing margins of the cleft are denuded and two small flaps of mucous membrane outlined to form the uvula. Dotted lines at sides are relaxation incisions which may extend through the posterior part of the bony palate when necessary for complete relaxation. *B*, palatal margins are sutured together in three layers using triple 0 chromic catgut for the nasal mucous membrane and muscle and silk for the oral mucous membrane. Iodoform gauze is tied around the palatal flaps to relieve tension on the suture line. The ends of this gauze may be packed in the side opening to prevent bleeding. When considerable scar tissue is present from previous operations, it is advisable to do the repair in two separate stages two weeks apart. The two-stage procedure insures adequate blood supply for the palatal flaps. *C*, method of secondary repair for opening in the hard palate. *C*, dotted outlines at sides indicate relaxation incisions which extend down to the bone. The two muco-periosteal flaps are then freed from the underlying bone, the opposing margins of the opening are denuded and the flaps sutured together to close the defect. *D*, diagram shows the muco-periosteal flaps sutured together and a strip of iodoform gauze beneath the flaps. This strip of gauze is tied around the flaps to relieve tension on the suture line until healing has occurred.

Young children who do not hear well will not learn to speak well, and the child with a cleft palate and a significant hearing loss presents a serious problem.

Our management has consisted of first attempting to immunize children against infections of the upper part of the respiratory tract with vaccines and general preventive measures. When this fails, we remove the adenoids and tonsils. Patients who have established good speech before operation are not greatly affected; children who have poor speech before operation are usually adversely affected by removal of the adenoids.

## CONCLUSIONS

1. The authors emphasize the fact that this presentation is in the nature of a preliminary report and that later statistical evaluations will be published, together with the factual data on which the statistics are based.

2. The lipoidol test for the adequacy of velopharyngeal closure after cleft palate repair appears to be a reliable test for the degree of nasality in the patient's speech. When the distance between the soft palate and the posterior pharyngeal wall is not greater than 1 mm. there is little if any nasality. As this distance increases nasality becames apparent.

3. A study of 133 cases of repair by the bone flap method demonstrated an absence of palatal openings (fistulas) in 113 cases, small openings in 9 cases, and moderately large openings in 11 cases.

4. Cephalometric study (growth study) of 94 cases in which the bone flap method was employed showed that the majority of patients had very minor retardation in the anterior-posterior growth of the maxilla (upper jaw), associated with considerable underdevelopment of the mandible (lower jaw) in the anterior-posterior and vertical dimensions.

5. A smaller percentage of patients had "pushed-in" faces. In these patients also the maxilla (upper jaw) was only slightly underdeveloped but the mandible (lower jaw) was grossly overdeveloped in the anterior-posterior dimension, so that the maxilla appeared to be recessed. It appears that these abnormalities in the growth of the mandible are associated with the cleft palate deformity rather than operative trauma or age at operation. Therefore, it appears advisable to operate on children with cleft palates at 14 to 18 months of age, before they begin to speak. In our series, patients who were operated on before they began to speak had less nasality than did those who had their cleft palates closed after they had learned to speak.

6. Crowding and crossbite are typical malocclusions associated with cleft palate, whether or not the latter is treated by operation. Neither crowding nor crossbite is related to surgical trauma. Both, however, are related to the type of original defect, since the incidence of both increases with the severity of the original defect.

7. In this series, the mean intelligence quotient (Stanford-Binet) was slightly higher than that of a comparable group of children without cleft palates. The mean social maturity of the patients, however, was low.

8. About 30 per cent of the patients with cleft palates had hearing loss according to audiometric tests. This deafness was usually of the catarrhal type associated with enlarged adenoids and tonsils.

## SCHLUSSFOLGERUNGEN

1. Die Verfasser betonen, dass die vorliegende Arbeit einen vorläufigen Bericht darstellt, und dass statistische Auswertungen sowie die Daten, auf denen sie beruhen, später erscheinen werden.

2. Die Lipiodolprobe zur Bestimmung der Zulänglichkeit des velopharyngealen Verschlusses nach Wolfsrachenoperationen eignet sich offenbar gut zur Bestimmung des Grades der Nasalität in der Sprache des Kranken. Wenn der Abstand zwischen dem weichen Gaumen und der hinteren Rachenwand nicht grösser als

ein Millimeter ist, ist die Nasalität, wenn überhaupt vorhanden, nur gering. Vergrössert sich der Abstand, macht sich Nasalität bemerkbar.

3. Eine Untersuchung von 133 mittels der Knochenlappenmethode operierten Fällen ergab die Abwesenheit von Gaumenöffnungen (Fisteln) bei 113 Kranken, kleine Oeffnungen in 9 Fällen und mässig grosse Oeffnungen in 11 Fällen.

4. Schädelmessungen (Wachstumsuntersuchungen) an 94 Fällen, an denen die Knochenlappenmethode ausgeführt worden war, ergaben, dass die Mehrzahl der Kranken nur geringe Verzögerungen im anteroposterioren Wachstum des Oberkiefers mit beträchtlicher Unterentwicklung des Unterkiefers in anteroposteriorer und vertikaler Richtung aufwiesen.

5. Ein kleiner Prozentsatz der Kranken zeigte ein "eingestossenes" Gesicht. Auch bei ihnen war der Oberkiefer nur wenig, der Unterkiefer aber in anteroposteriorer Richtung stark unterentwickelt, sodass der Kiefer zurückgeschoben erschien. Offenbar sind diese Wachstumsstörungen des Unterkiefers mit dem Wolfsrachen verknüpft und hängen wohl weniger von dem operativen Eingriff oder vom Alter des Kranken bei der Operation ab. Daher erscheint es ratsam, Kinder mit Wolfsrachen im Alter von 14 bis 18 Monaten, bevor sie anfangen zu sprechen, zu operieren. In unserer Krankenserie zeigten die Kinder, die, bevor sie anfingen zu sprechen, operiert wurden, geringere Nasalität als die, bei denen der Wolfsrachen geschlossen wurde, nachdem sie sprechen gelernt hatten.

6. Zusammendrängen der Zähne und Bissveränderungen sind typische mit Wolfsrachen einhergehende Kieferschlubstörungen, gleichgültig ob eine Operation vorgenommen wurde oder nicht. Die Störungen sind vom chirurgischen Trauma unabhängig, stehen aber in Beziehung zu der Form der ursprünglichen Missbildung, da ihr Häufigkeit mit der Schwere der ursprünglichen Missbildung zunimmt.

7. In der hier veröffentlichten Serie war der Intelligenzquotient (Stanford-Binet) etwas höher als bei einer Vergleichsgruppe von Kindern ohne Wolfsrachen. Die durchschnittliche soziale Reife der Kranken hingegen war gering.

8. Etwa 30% der Kranken mit Wolfsrachen hatten nach audiometrischen Untersuchungen Gehörsverlust aufzuweisen. Die Taubheit beruhte gewöhnlich auf katarrhalen Veränderungen, die mit einer Vergrösserung des adenoiden Gewebes und der Mandeln einhergingen.

## CONCLUSIONES

1. El autor hace notar el hecho, de que esta presentación es de naturaleza preliminar y de que se publicarán en el futuro valoraciones estadísticas posteriores junto con los hechos en los cuales estan basadas.

2. La prueba con lipiodol para el cierre adecuado del velo faríngeo después de la reparación de hendidura palatina, parece ser una prueba de confianza para el grado de rinolalia en el paciente. Cuando la distancia entre el paladar suave y la pared posterior de la farínge no es mayor de 1 mm., no existe ó bien existe poca rinolalia. Conforme esta distancia aumenta la rinolalia se vuelve aparente.

3. Un estudio de 113 casos de reparación por el método del colgajo óseo, demostró ausencia de aberturas palatinas (fístulas) en 113 casos, pequeñas aberturas en 9 casos y aberturas moderadamente grandes en 11 casos.

4. El estudio cefalométrico (estudio de crecimiento), de 94 casos en los cuales se uso el método del colgajo óseo, mostró que la gran mayoría de los pacientes tienen retardo mínimo en el crecimiento anteroposterior del maxilar superior, asociado con falta de desarrollo considerable de la mandibula (maxilar inferior) en las dimensiones antero-posterior y vertical.

5. Un porcentaje menor de pacientes, presentaron caras "hundidas." En estos pacientes, también el maxilar superior estaba muy ligeramente subdesarrollado, en tanto la mandíbula (maxilar inferior) estaba subdesarrollada grandemente en la dimensión antero-posterior, de manera que

la mandíbula parecía escondida. Parece, que estas anomalías en el crecimiento mandibular estan asociadas con la deformidad palatina más que con el trauma operatorio ó la edad en la que se practica la operación. Por sonsiguiente, parece aconsejable operar en niños con hendiduras palatinas de los 14 a los 18 mesesde edad, antes de que empiezen a hablar. En nuestras series, los pacientes que fueron operados antes de empezar a hablar, tuvieron menos rinolalia que aquellos cuyos paladares fueron cerrados después de haber aprendido a hablar.

6. Voz vitonal y maticación defectuosa, son oclusiones defectuosas, asociadas típicamente con hendidura palatina, haya sido ó no tratada por operación. No estan relacionados al trauma quirúrgico. Sin embargo, estan relacionados al tipo de defecto original, ya que su incidencia aumenta con la gravedad del defecto original.

7. En estas series, el coeficiente de inteligencia promedio (Stanford-Binet) fué ligeramente más alto que el de un grupo comparable de niños sin hendidura palatina. Sin embargo, el promedio de madurez social fué baja.

8. Un 30 por ciento de los pacientes con hendidura palatina, tuvieron pérdida de la audición, de acuerdo con pruebas audiométricas. Esta sordera fué usualmente de tipo catarral asociada con adenoides y amígdalas hipertrofiadas.

## CONCLUSOES

1. Os autôres salientam o fato de que a apresentação deve sêr a base de qualquer trabalho médico, vindo em seguida uma apreciação acêrca da estatistica, juntamente com os fátos nos quais foi a mesma fundamentada.

2. Sugere que o lipiodol deve servir como prova para availação do grau de nasalidade na voz dos pacientes operados de véu palatino, tecendo comentarios sôbre a extensão da plástica e a incidencia de nasalidade que é fatôr desta.

3. Em 133 casos operados, revela o autôr excelentes resultados em 113 doentes, pequenas deiscencias em 9 casos, e fendas mais pronunciadas em 11.

4. Foi feito exame cefalometrice em 94 doentes, com interessantes revelações.

5. Pequena porcentagem de outras deformidades foi verificada nêsses doentes. Oa estatistica dos autôres, os doentes operados antes de começarem a falar, isto é, entre os 14 e os 18 mêses, verificou-se *menor nasalidade posterior do que naquêles* operados após a parlação.

6. Tecem comentarios sôbre a natureza de outras malformações que acompanham a fenda palatina, e a origem do seu desenvolvimento.

7. Concluem, baseado em suas observações, que o nivel de inteligencia dos doentes é ligeiramente mais elevado que um numero comparado de meninos que não possuiam tal deformidade. Todavia, frizam, o nivel social na maturidade dêsses pacientes é mais baixo.

8. Cerca de 30% de doentes portadôres de fenda palatina, demonstram diminuição de audição segundo os testes audimetricos. Explica-se tal fate por perturbações adenoidianas e amigdalianas.

## RIASSUNTO

1. Gli autori sottolineano il fatto che il lavoro ha il carattere di una nota preliminare e che più tardi verranno pubblicate le conclusioni statistiche assieme ai dati su cui sono basate.

2. Il lipiodol può fornire dati assai attendibili sul grado di nasalità della voce in pazienti operati per palatoschisi: quando, infatti, la distanza fra palato molle e parete posteriore della faringe non è più grande di 1 mm. non c'è tono nasale o ce neè poco. Man mano invece che tale distanza crece comincia a manifestarsi la nasalità.

3. Una revisione di 133 casi operati di plastica del palato con lembo osseo ha dimostrato assenza di fistole il 113 casi, fistde di piccolo calibro in 9 casi, di calibro abbastanza grande [illegible]

4. Studi cr[illegible] casi operati [illegible]

lembo osseo hanno mostrato che la maggioranza dei pazienti hanno un piccolo ritardo di accrescimento del mascellare superiore in osenso antore-posteriore, associato ad una notevole ipoplasia della mandibola sia nel senso antero-posteriore che in quello verticale?

5. In una piccola percentuale di pazienti il mascellare superiore aveva pure subito un piccolo ritardo d'accrescimento, mentre la mandibola era fortemente ipoplasica in senso antero-posteriore. Sembra che tale malformazione della mandibola sia associata colla palatoschisi. Perciò è consigliabile operare i bambini affetti da palatoschisi alla età di 14-18 mesi, prima che comincino a parlare. Nella nostra casistica, le voci dei pazienti operati prima che cominciassero a parlare, erano meno nasali, mentre lo erano assai di più le voci di quelli operati quando già avevano imparato a parlare.

6. In questa serie di pazienti il paziente d'intelligenza (Stanford-Binet) fu di poco maggiore di quello di un gruppo di bimbi senza palatoschisi, ma il grado di maturità sociale, veceversa, fu basso.

7. Circa il 30 per cento di pazienti affetti da palatoschisi avevano pure diminuzioni dell'udito, di solito in rapporto coi fatti catarrali dipendenti da ipertrofia delle tonsille e delle adenoidi.

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Rutherford Morison is honoured everywhere in the world. He was great by any definition, because he excelled alike in those qualities of the head, the hand, and particularly of the heart that make for greatness in surgery. He was, perhaps, fortunate in that, being endowed with a great brain, he was not subjected to any system of education such as we are planning to-day for the surgeons of the future, designed to mould them to our own conception of the ideal surgeon. He educated himself, and he spent his early years in general practice, where he gained that intimate insight into human nature that was one of his most endearing characteristics. Having entered surgery, he became and remained through life a student of pathology. Of his manual skill many can speak with greater authority than I, but as an operator he was ahead of his time. He will, perhaps, be remembered best by his operation for ascites and by the right kidney pouch which bears his name, but he was also a pioneer in operations for cancer of the breast, in the dissection of cervical glands, and in gastrectomy. He remained through life a great practical surgeon, careful in undertaking, thorough in performance. Rutherford Morison excelled in qualities of the heart. His teaching was human, vivid, and personal, based on his knowledge and love of the Tynesiders who were his patients and his students. He taught in general principles, which the problem in hand was used to illustrate. And because he was a great man as well as a great surgeon, he handed on the spirit as well as the letter of his creed, and became the greatest disseminator of surgical thought and the greatest maker of surgeons within living memory.

—*Ogilvie*

# Reconstruction of the Ear with Semilunar Knee Cartilage Preserved by Deep Freezing

## Preliminary Report

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ALL reconstructive surgeons will readily admit that the problem of reconstructing the auricle is one to test the ultimate skill and technic of the surgeon. The dilemma is that it is difficult to get consecutive good results in a series of cases by any of the methods at present available. It appears that the experience of the operating surgeon is more important than the method used.

Gilles observed in 1937 that the study of one's own and other surgeons' actual results reveals unanimous disappointment in the cosmetic results obtained. This holds true today.

The problem is, Can an ear be built that is presentable and satisfying to the patient, in a limited number of operative procedures?

The various methods described by Davis (1929), Lockwood, Beck, Pierce (1930), New (1931), Gilles (1937), Brown, Peer (1947) and the various substances employed, which include ivory, steel, silver, gold, tantalum, paraffin, rubber, wood, glass, resins, acrylics, bone and cartilages, are the basis of present-day concepts.

Cartilage stands out as the material that fulfills the most demands in the greatest number of cases. The arguments in favor of autogenous cartilage over preserved cartilage are still in progress, but, by common usage in an ever-increasing number of successful cases, preserved cartilage is being accepted and used routinely. Hyaline cartilage has the widest range of usefulness, because of its availability in quantity from the costal cartilages. Other varieties of cartilage are of the fibrocartilagenous type, which, when the connective tissue fibers are of a white variety, is termed white fibrocartilage and when they are yellow is termed elastic fibrocartilage. The semilunar cartilages belong to the last-mentioned group. All types have been implanted successfully.

Philip D. Wilson in 1946, in the Hospital of Special Surgery in New York City, started the first deep freeze project for preservation of homogenous bone. The principles of rapid freezing are of paramount importance in the protection of cellular integrity. If cooling is slow, the water and salts separate and cells are destroyed by the formation of large ice crystals. It is to be emphasized that immediate freezing is of great importance; it defeats possible contamination by room bacteria, and if it is completed within one-half hour cellular integrity is almost always maintained. It is of interest to note that commercial fisheries report that fish frozen on leaving the water can live and swim again months later if they are carefully thawed. Experience has shown that the best temperature at which to freeze bone lies between 30 and 40 C.

Resistance of pathogenic bacteria to cold is variable. Bacillus pyocyaneus can resist a temperature of —75 degrees; bacillus tuberculosis, a temperature of —200 degrees. Treponema can regain its mobility and virulence after four months' preservation at —78 degrees. Staphylococci held at —30 degrees resumed growth with normal virulence after the lapse of months. On the other hand, the vitality of Bacillus coli and Bacillus typhus is reduced by cold, and all bacteria, even if unharmed, cease to grow when in contact with cold.

J. J. Herbert has advised storage in sealed glass tubes [illegible] y in

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freezing liquid—ethyl glycol and water. Freezing occurs more rapidly if conduction is by a fluid than if it is by air.

O'Connor, in 1938, in collaboration with Pierce, suggested merthiolate preservation of rib cartilage at refrigerated temperatures. This method has won wide acceptance and represents a considerable contribution to plastic surgery. Emphasis on sterile procurement and immediate freezing prior to cleaning perichondrial cartilage was advocated.

The chief disadvantages in the use of preserved cartilage are that there is more absorption than with fresh autotransplants and more reaction in the recipient tissues, caused by the preservative used. Brown in 1940 suggested that preservation of cartilage by freezing might be preferable to the merthiolate saline method if a good source of sterile cartilage could be found. With the establishment of cartilage banks in most large plastic services, standardization of methods of procuring, and preservation with careful bacteriologic control, a constant source of material has been made available which has proved highly satisfactory and economical.

With the advent of the bone bank and deep freeze preservation, a sterile source of semilunar knee cartilage was made available. At the time of an amputation or an operation on the knee joint, individual jars are supplied to receive the semilunar cartilages, which are placed directly in the deep freeze at —40 C. Cultures are taken at weekly intervals, and the cartilage is ready for use after four sterile cultures (Wilson).

The technics of ear reconstruction vary the country over, but all embody essentially the insertion of cartilage under the preauricular skin and the subsequent establishment of a postauricular sulcus by skin grafting. Both the use of a large block of preserved cartilage (Aufricht), with subsequent carving out of the anatomic relation, and the use of detailed metal molds filled with diced cartilage and buried in the anterior abdominal wall until, at a later date, the cartilage replica can be inserted beneath the preauricular skin (Peer) are recognized as progressive, but both methods fail to maintain the details of auricular form, owing to the fact that the skin does not adhere exactly. The use of skin tube pedicles in reconstructing the helix has failed to deliver consistently good cosmetic results.

I have been privileged to see many reconstructed ears in the various clinics and must admit that they look fairly good; but the best ones were those achieved by Steffenson at Grand Rapids. He advocates maintenance of the postauricular sulcus by the use of a bipolar or unipolar full thickness skin flap from the mastoid region, with free skin grafts to the remaining raw surfaces and the insertion of a previously carved hinged cartilage which provides a finely shaped auricle with an excellent postauricular angle.

In a personal communication, O'Connor stated that he has used merthiolate-preserved knee cartilage with success. It is to be noted that semilunar knee cartilage provides a normal curved shape, especially for the upper pole of the ear. If one combines two fractured semilunar cartilages or lays a fractured cartilage on the upper pole of a complete one, a reasonable facsimile of an auricle can be obtained. It must be admitted that no effort to effect the fine anatomic design has been attempted, as the preauricular skin will not follow closely in healing. An attempt has been made to create the skin pocket a bit too small, so that an accentuated curve is produced in the semilunar cartilage by stress warping. M. A. MacConnaill of Ireland stated that collagenous fibers of hyaline articular cartilage are arranged in bundles, which is probably the consequence of the strains to which the cartilage is subjected during postnatal development. He suggested a Law of Collagenization: As iron filings are to a magnetic field, so are collagenous fibers to a tension field.

It is suggested that these naturally shaped cartilages provide elasticity and flexibility beyond that of costal hyaline cartilage. Their reaction to infection is equal to that of other forms. Special technical details in applying the postauricular skin graft to the preauricular skin. The choncal area serves as the bed on which one places the skin graft, thus achieving depth of choncal area and thinness of auricle. Planned skin folds to simulate the antihelix and the triangular fossa are elevated and maintained by mattress sutures. The result is healing of the skin ridges without cartilagenous support, which in relief give accentuated shadow lines of conformation.

It has been my experience that deep-frozen semilunar fibrocartilage causes minimal reaction. When such cartilage is placed under an anterior auricular skin thinned sufficiently in a small pocket, an auricle is created that has a more earlike feeling, is softer and more flexible and presents a fair ear contour. Patients have not complained so much in extremely cold weather and have no discomfort when lying on the reconstructed ear.

Success in handling this type of cartilage inlay is enhanced if a postoperative pressure dressing of moist cotton accurately molded to the newly established contours is maintained in place for at least ten days. It forms a splint on drying and is a most satisfactory dressing.

A combination of cartilage preserved in merthiolate-saline and semilunar cartilage preserved by deep freezing has been used without reaction, a softer rolled upper pole being created. It has been my practice to insert semilunar cartilage without any attempt at reconstruction of the helix by a tubed pedicle, and, though the end result is not perfect, it is acceptable, and the number of procedures is kept to three or four. In some cases a "setback" procedure has been performed on the normal ear, the full thickness of skin being placed in the postauricular sulcus and the upper pole area of the reconstructed ear, thus creating a satisfactory bilateral appearance.

## SUMMARY

This preliminary report is presented with the hope that it may be incorporated into the armamentarium of plastic surgery as another method to be used toward the ultimate improvement of ear reconstruction. Deep freezing provides a direct basic method of sterile preservation, and the menisci lend themselves readily to this type of reconstruction, providing a soft, flexible, normal-feeling ear.

## RÉSUMÉ

L'auteur présente ce rapport préliminaire dans l'espoir que la technique décrite pourra être utilisée en chirurgie plastique comme une méthode pouvant faciliter la chirurgie plastique de l'oreille. La congélation à basse température est une bonne méthode de conservation stérile. Les ménisques se prêtent très bien à ce genre d'opération. L'oreille ainsi obtenue est élastique et d'une sensibilité normale.

## ZUSAMMENFASSUNG

Die Arbeit wird als vorläufiger Bericht veröffentlicht in der Hoffnung, dass ein neues Verfahren zur endgültigen Wiederherstellung des Ohres dem Rüstzeug des plastischen Chirurgen hinzugefügt werden könne. Die sterile Konservierung mittels Gefrierens bei tiefen Kältegraden ist als ein direktes grundlegendes Verfahren anerkannt, und die Knorpelscheiben des Kniegelenks eignen sich gut als Ersatzmaterial zur Herstellung eines weichen, biegsamen, sich normal anfühlenden Ohres.

## RESUMEN

Se comunica este artículo preliminar con la esperanza de pueda ser incorporado al arsenal de la cirugía plástica, como otro medio que pueda usarse para mejorar la reconstrucción de la oreja. El congelamiento profundo proporciona un método básico directo para la preservación estéril, [illegible] me[illegible]s para su uso inmediato [illegible] [illegible]strucción. [illegible] blandura [illegible]

### RIASSUNTO

Comunicazione preventiva, che ha lo scopo di incoraggiare la diffusione di questo metodo di ricostruzione dell'orecchio. Le basse temperature consentono di conservare sterilmente i menischi, che rappresentano un mezzo quanto mai idoneo per questo tipo di ricostruzione plastica.

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A work that aspires, however humbly, to the condition of art, should carry its justification in every line. And art may be defined as a single-minded attempt to render the highest kind of justice to the visible universe, by bringing to light the truth, manifold and one; underlying its every aspect. It is an attempt to find in its forms, in its colours, in its light, in its shadows, in the aspect of matter and in the facts of life, what of each is fundamental, what is enduring and essential—their one illuminating and convincing quality—the very truth of their existence.

—*Conrad*

# Sección en Español

## Nefrectomia Parcial por Tuberculosis

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EN UROLOGIA la cirugia conservadora tiende cada vez más a desplazar la exéresis total del órgano enfermo en el tratamiento de muchas afecciones urogenitales, bien de origen inflamatorio más o menos activas, las residuales o cicatriciales a estas e incluso ciertas neoplásias; prueba de ello es el lugar que progresivamente ha alcanzado la *epididectomia*, que en la tuberculosis genital es indiscutida; la pielotomia ha substituido a la nefrostomia, incluso para la extracción de grandes cálculos y solo en ocasiones excepcionales se acude a la *nefrostomia localizada* o *calicectomia* antes que proceder a la nefrectomia; la cistectomia parcial aunque supeditada a la precocidad del diagnóstico se afianza por múltiples razones en frente a la cistectomia total, etc.

Durante la última década se observa la revalorización de la extirpación de la porción de rinñón enfermo y conservar la parte indemne o sana del órgano; es decir, la Nefrectomia Parcial método terapéutico que va siendo utilizado en la mayoria de las enfermedades renales siempre que la lesión se circunscriba en una zona de riñón de fácil extirpación, sin que con ello se altere la irrigación sanguinea del resto y las vias de excresión pielo-ureterales se conserven expeditas despues de la operación; sin estas dos condiciones la Nefrectomia Parcial no es aconsejable.

Dos factores de órden clínico han influido en la mayor práctica de la Nefrectomia parcial; la precocidad y pulcritud diagnóstica de las afecciones renales, ello facilita el descubrimiento de la lesión renal en su comienzo y si su limitación resta a una zona que permita la extirpación de la lesión, esta será aconsejable antes que le enfermedad invada el resto del riñón. También el mejor conocimiento actual del curso evolutivo de las afecciones renales permite esperar la estabilización irreversible de la lesión de lo cual en gran manera depende la oportunidad para la N.P.

*En el órden técnico el mejoramiento general* de los procedimientos quirúrgicos y el empleo de nuevos farmacos (sulfamidas, antibióticos, etc.) en la preparación preoperatoria y en el post-operatorio de estos *enfermos, ha favorecido la practica* de la N.P. en especial en la tuberculosis, cuyas drogas han facilitado la cura o la estabilización de la pequeñas lesiones dando lugar al desarrollo de lesiones residuales o secundarias, creando una nueva patologia. Estas lesiones por hoy mejor conocidas, es obligada su eliminación para complementar la acción de aquellas drogas y asi conservar el resto del riñón sano, pues, de no actuar asi debemos proceder a la ectomia total como hasta la fecha se sigue.

Mi experiencia en N.P. se inició al año 1930 epoca en que ni sulfamidas ni antibióticos estan en uso y la primera N.P. por tuberculosis fué practicada al año 1943, fecha en que ocurria lo mismo, con relación a esta infección; a pesar de la falta de antibióticos los resultados obtenidos desde las primeras N.P. me alentaron a proseguir practicando esta cirugia conservadora; si bien en aquel entonces las, indicaciones de esta cirugia en la Tbs. eran escasas; en la actualidad son más frecuentes, favorecidas como ha sido indicado, por los mejores medios de exploración, su prodigalidad y la acción de las d [illegible]

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Acerca la benignidad de la N.P. debo decir que en mi experiencia de 75 N.P. por diferentes afecciones (litiasis, anomalias, infecciones, tumores, traumatismos, tuberculosis, etc) solo he tenido que lamentar 5 defunciones: dos casos en niños de menos de 3 años afectos de uretero-hidronefrosis por duplicidad ureteral; una en una mujer afecta de crisis dolorosas por duplicidad pielo-renal; la cuarta ocurrió en un enfermo con caliciectasia y la quinta defunción fué un paciente de tuberculosis renal bilateral. En ambos niños, la defunción fué producida por el sindrome de palidez e hipertemia que la pediatria no acababa de definir; la mujer falleció por

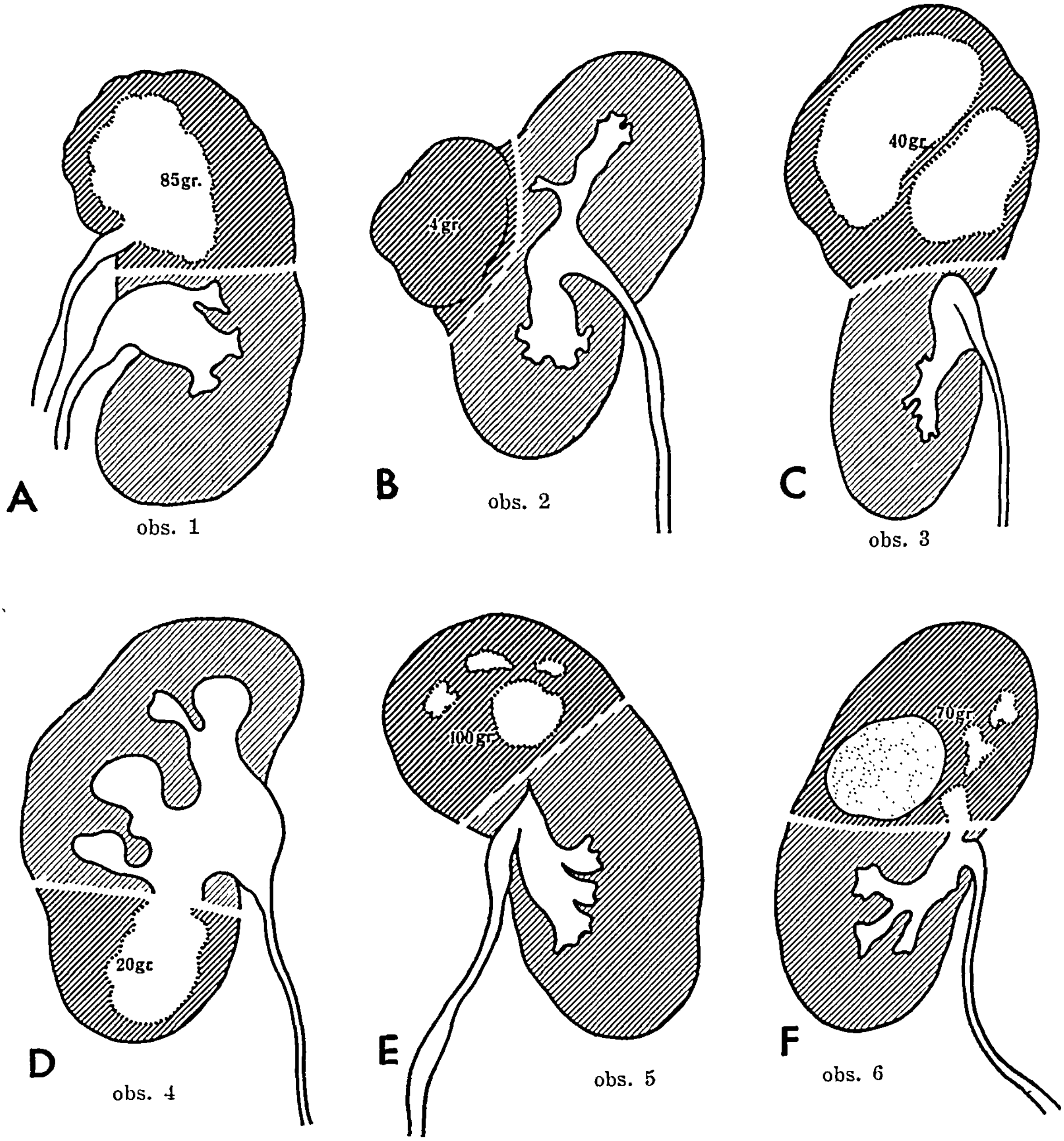

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Fig. 1.

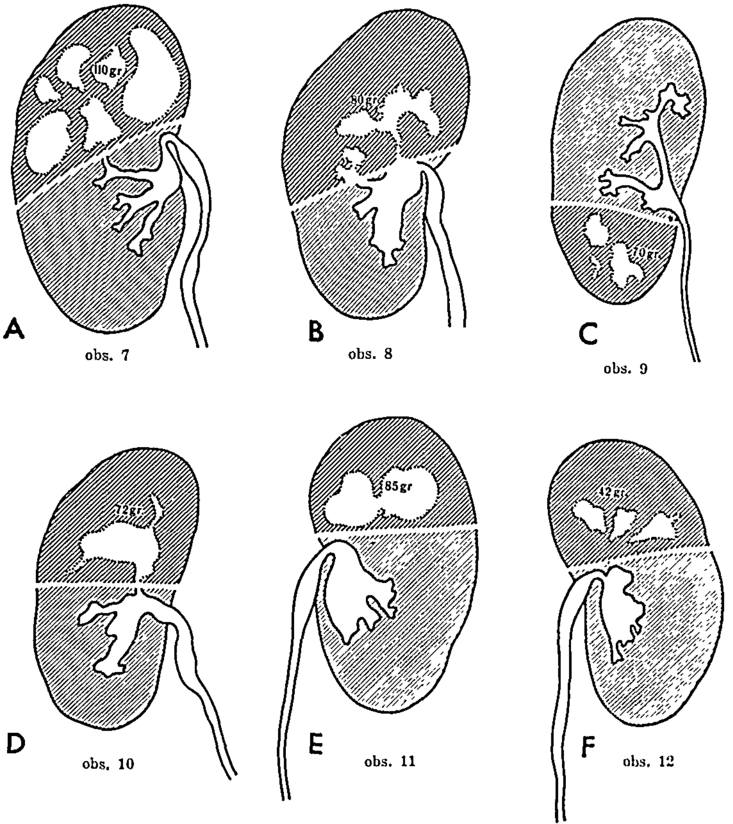


Fig. 2.

miocarditis al tercer dia del post-operatorio; el cuarto, un hombre, con crisis dolorosas por retención en cáliz superior falleció al tercer dia y si bien en esta ocasión fué posible la necropsia no se observó en la región operatoria ninguna alteración imputable al acto quirúrgico que justificase la defunción. Finalmente la última defunción se ha producido en un paciente con exclusión total tuberculosa del riñón izquierdo y exclusión de polo inferior del riñón derecho que justificó la N.P. de este polo renal y el enfermo falleció a las 7 horas de haber sido operado con un cuadro de schoc toxi-tuberculoso hipertemia a 41°, palidez y sudoración prof colar periférico con anoxia.

La N.P. ha sido realizada en 22 pacientes afectos de tuberculosis renal; en 18 enfermos la lesión estaba limitada a uno de los dos riñones; 3 eran enfermos con riñón único por haber sido anteriormente nefrectomizados y el restante era un paciente con total exclusión del riñón derecho y que a su vez presentaba una lesión excluida en el polo inferior del riñón opuesto.

En una ocasión, la N.P. fué practicada con diagnóstico equívoco de nefroptosis y en otro de litiasis, en ambos casos al examinar el riñón durante el acto operatorio, se observaron lesiones de tuberculosis circunscritas y excluidas que justificaron la N.P. que solo habia sido propuesta en uno de los casos (obs. 3 y 4).

Estas 22 intervenciones fueron llevadas a cabo con éxito completo, excepto en el caso ya citado (obs. 20) que el enfermo falleció a las 7 horas en un cuadro de schoc; de los 21 operados restantes sobreviven 20 pacientes, pues, solo uno de estos operados (obs. 2) murió a los cuatro años de practicada la N.P. en su riñón único por la evolución progresiva de la infección tuberculosa en este trozo de riñón.

La enferma de más larga supervivencia (obs. 1) operada en 1943, sigue muy bien al punto que actualmente se dedica a los trabajos del campo; en un caso (obs. 3) se ha producido la anulación funcional del trozo de riñón conservado, demostrada por la negatividad de la cromocistoscopia y de la urografia. Entre los 21 enfermos supervivientes, no he observado ninguna fistula urinaria lumbar persistente que obligase a la ectomia del trozo de riñón conservado. Solo en un enfermo de riñón único, pues habia sido nefrectomizado seis años antes por tuberculosis (obs. 9) la salida de orina por la herida lumbar persistió durante cuatro meses fecha en que se completó la total recuperación del enfermo, en este caso el post-operatorio fué agitado, la urea sanguinea alcanzó la cifra de 4 gramos por mil, que persistió varios dias, mejorando luego progresivamente; en la actualidad a los 18 meses de la operación el enfermo está bien de su sistema renal y dedicado a su trabajo habitual; hasta recientemente que se ha producido una lesión ósea vertebral dorsal (Mal de Pott), y a pesar del trozo de riñón ha sido posible lo curación.

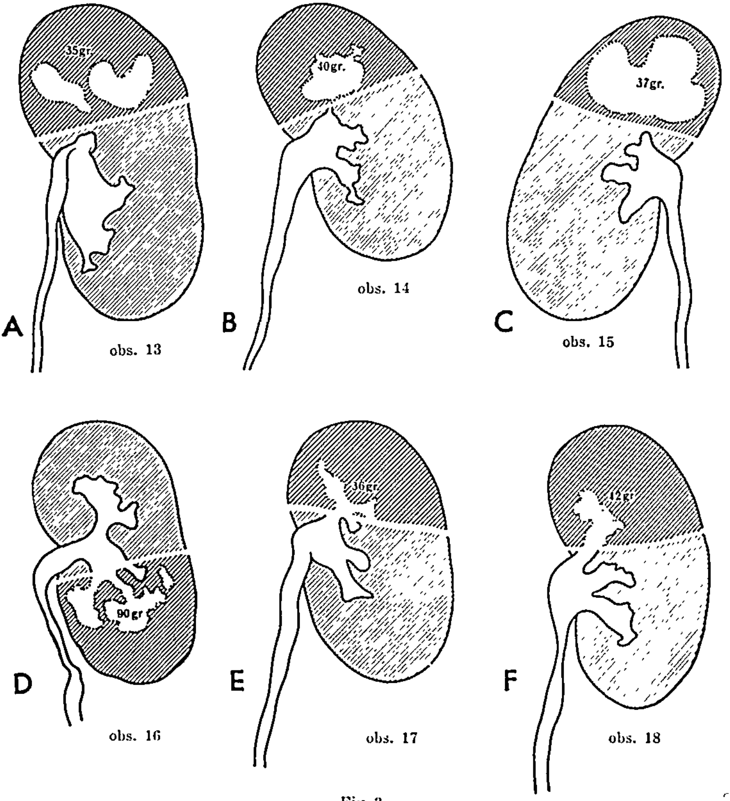
La técnica de la N.P. en la actualidad está sometida a revisión y ello justifica constantes variaciones y hacer hincapié en algunos detalles; siempre que las condiciones morfológicas del pediculo, distribución vascular y seno del riñón lo permitan-débese proceder a la ligadura hemostática y preventiva de las ramas arteriales y venosas que por observación directa se compruebe irrigan y desagun la zona renal a resecar; solamente la hemostasia preventiva es practicable cuando la zona a extirpar corresponde a un polo del riñón y con ello se corrigen exéresis parciales casi exángues.

Es del todo desaconsejable practicar la hemostasia temporal mediante la compresión del pediculo tanto instruiental (con pinzas elásticas cubiertas de goma), como manual (por compresión digital o por lazo); estos métodos de hemostasia suelen ser insuficientes pues lo que primero la compresión colapsa es la vena renal y con frecuencia la arteria queda comprimida insuficientemente lo cual favorece lo extásis circulatorio en el riñón y la hemorragia consiguiente.

En ocasiones sin compresión del pediculo suele observarse que la hemorragia parenquimatosa cesa al reintegrar el riñón exteriorizado a la celda lumbar, ello es debido a que con el estiramiento del pediculo la vena renal queda aplanada y se restringe la circulación de retorno dando lugar a congestión renal.

Cuando durante la sección del parenquima sangra algún vaso arterial, bastará que el propio operador o un ayudante comprima con el pulpejo del dedo la boquilla vascular mientras y tanto se procede a la regularización del corte renal, luego estas boquillas vasculares son facilmente pinzadas y se procede a su ligadura siendo recomendable se practiquen mediante transfixión con catgut atraumático.

En los últimos tiempos ha aumentado en la tuberculosis la incidencia de lesiones que justifican la práctica de la N.P.; ello se debe por una parte a la mejor exploración de estos pacientes y por otra a la influencia de los antibióticos, cura de reposo, etc. que durante estos últimos años han sido sometidos estos pacientes; esta terapeutica ha modificado las formas anatomo-clinicas de esta afección y además, con la esperanza de alcanzar la curación médica se ha postergado la nefrectomia precoz; por este último motivo y la metódica y repetida vigilancia de los enfermos, ha dado a conocer en gran número de casos la evolución anatomo-clinica de las lesiones y descubrir los caracteres de estabilización de la infección sobre cuyos hechos se fundamenta principalmente la indicación y oportunidad de la N.P.



obs. 13 obs. 14 obs. 15

obs. 16 obs. 17 obs. 18

Fig. 3.

Quiero señalar un hecho de frecuente observación al practicar la N.P. que para muchos justifica la exéresis total: es la presencia de algurus tubérculos en la cortical de la porción de riñón a conservar. Si procedemos sin la menor especulación critica, es lógico pensar que dejar al enfermo una porción de riñón con tales lesiones constituye una herejia quirúrgica, pero luego la experiencia niega el anterior criterio; si derivamos estos hechos por el camino de lógicas deducciones están son tan simples que por su propia simplicidad soprenden, pues, no debemos olvidar que en la Nefrectomia Total son muchos los tubérculos que restan en la celda renal, ganglios hiliares, ureter, etc. y que luego curan sin dejar secuelas; pues bien esto o algo parecido parece ocurrir en el trozo de riñón conservado ya que la posterior observación de estos enfermos, no revela signos de tal lesión.

La sutura o ligadura del cáliz seccionado al amputar el riñón es innecesaria y a su vez de técnica engorrosa sin ninguna utilidad ya que la indicación de esta técnica de prevenir la fistula ulterior, no puede ser soslayada mediante tal sutura sino que depende solo y exclusivamente de la integridad de las vias excretoras del riñón, si estas se conservan despues de la res ción en buen estado, condición imprescindible para la N.P. la orina segregada será toda recolectada por las vias urinarias, siendo la sutura innecesaria, y el muñón pielo-calicilar se ocluye espontáneamente; por el contrario si se produce obstáculo en la evacuación piélica la orina vence la sutura y refluye por la herida lumbar.

## CASUISTICA

*Obs. 1* (7) R.G. mujer de 55 años. (Fig. 1*A*.). Diagnóstico: Duplicidad pielo-ureteral izq. con TBs. en la mitad superior. B.K. positivo. Tratamiento: Reposo pre-operatorio. Sin antibióticos. Resección de la mitad superior del riñón izq. (1943). Peso del fragmento extirpado: 85 grs. Resultado: Curación en 1952. B.K. negativo.

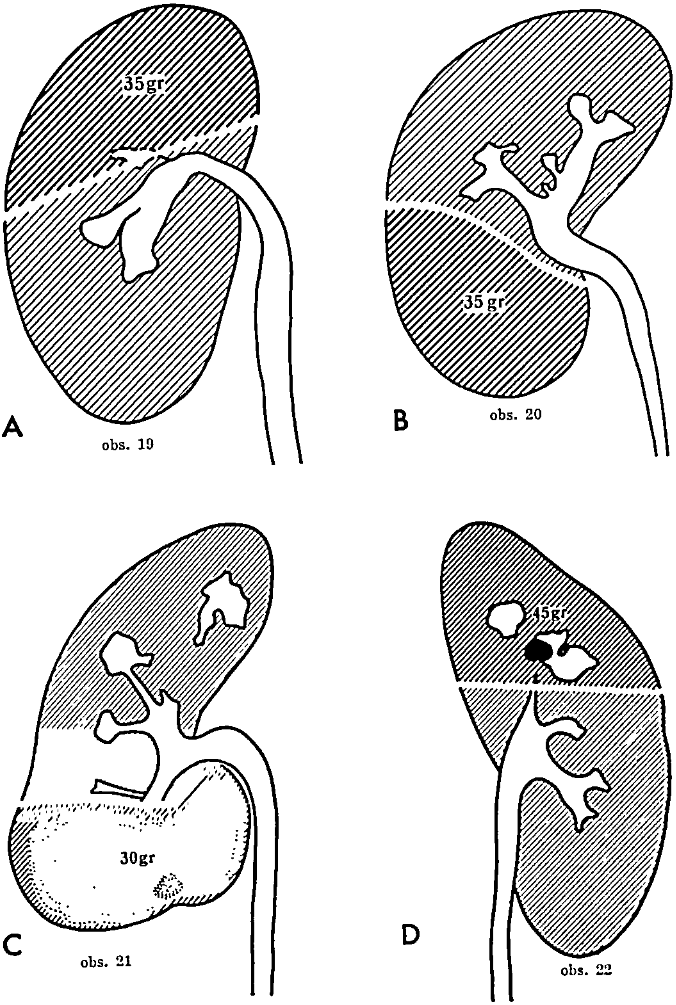
*Obs. 2* (21) P.S. Mujer de 28 años. (Fig. 1*B*.). Diagnóstico: Tuberculosis renal bilateral. B. de Koch, positivo. Tratamiento: Nefrectomia lumbar derecha, a los 19 años (1940). Sin antibióticos. Resección de la caverna quistica excluida en el tercio medio cara anterior del riñón izquierdo a los 28 años (1947). En tres ocasiones se ensaya la Streptomicina que no toleró; tampoco toleró el P.A.S. Peso del fragmento extirpado: 4 gramos. Resultado: A los 31 años cistitis, mal estado general, nauseas, febricula, accesos dolorosos de cólico renal y reaparición del B.K. en orina. Fallece por insuficiencia renal a los 32 años (1952).

*Obs. 3* (32) C.M. Mujer de 39 años. (Fig. 1*C*.). Diagnóstico clinico: Nefroptosis izquierda. Diagnóstico operatorio% Tuberculosis cavernosa polar superior. B. de K. positivo. Tratamiento: Sin antibióticos. Resección mitad superior del riñón izquierdo (1948). Peso del fragmento extirpado: 40 gramos. A los 3 meses despues de la N.P. por exámen cistoscópio, no se observa eliminación de carmin de índigo y la pielografia por eliminación fué deficiente. Resultado: Curación clinica. B.K. negativo.

*Obs. 4* (43) M.G. Varón de 53 años. (Fig. 1*D*.). Diagnóstico clinico: Litiasis renal bilateral. Diagnóstico operatorio: Cálculo piélico derecho. Caseosis tuberculosa calcificada en polo inferior riñón izquierdo. B. de K. negativo. Tratamiento: Sin antibióticos. Pielotomia derecha (VIII, 1949). Resección polo inferior izq. (XI, 1949). El exámen operatorio constató lesión caseosa Tbs. que el exámen anatomo-patológico confirmó. Peso del fragmento extirpado: 20 gramos. Resultado: Curación clinica. B.K. negativo; polaquiuria con orina pálida y recidiva de cálculo renal derecho (1952). Orina de riñón izquierdo. Albúmina: 0.15 gramos por mil; Urea 5'5 gramos por mil; escasas celulas pavimentosas; abun antes leucocitos; abundantes hematies; B.K. negativo.

*Obs. 5* (47) J. C. Varón de 34 años. (Fig. 1*E*.). Diagnóstico: Tuberculosis uro-genital. B. de K. positivo. Tratamiento: Epididectomia der. (XI, 1948). Estreptomicina 40 gramos. Reposo un año. Resección mitad superior riñón derecho (XI, 1950) 10 gramos Estreptomicina post-operatorios. Peso del fragmento extirpado: 100 gramos. Resultado: Curación Reintegrado al trabajo en 1952. B.K. negativo.

*Obs. 6* (48) F.G. Varón de 53 a. (Fig. 1*F*.). Diagnóstico: Tuberculosis caseosa polo sup. riñón izq. B. de Koch positivo. Tratamiento: 90 grs de Estreptomicina pre-operatoria y re-



obs. 19

obs. 20

obs. 21

obs. 22

Fig. 4.

poso. Resección tercio superior riñón izq. (1950). 40 gramos de Estreptomicina y P.A.S. post-operatorio. Reposo. Peso del fragmento extirpado 70 grs. Resultado: Queda pequeña fistula lumbar urinaria intermitente. En Febrero 1952 ureterocistorrafia extravesical izq. por ureteritis terminal estenosante seguida del cierre de la fistula y curación clinica (en 1953 ha tenido un hijo). Orina del riñón izq. Albúmina 0.25 grs %o; Urea 12.50 grs %o; algunas celular epiteliales, algunos leucocitos; bastantes hematies; B.K. negativo.

*Obs. 7* (52) A.A. Varón de 33 a. (Fig. 2*A*.). Diagnóstico: Tuberculosis urogenital. B. de Koch, positivo. Tratamiento: Epididimectomia izq. en 1949 y der en 1951. Resección polo superior izq. (VIII, 1951)—3.5 gramos de estreptomicina post-operatoria. Peso del fragmento extirpado 110 grs. Resultado: Curación en 1953. B.K. negativo. Cistitis residual.

*Obs. 8* (53) T.V. Mujer de 44 a. (Fig. 2*B*.). Diagnóstico: Tuberculosis riñón izq. B. de Koch, positivo. Tratamiento: 25 gramos de Estreptomicina y reposo pre-operatorio. Resección polo superior izq. (IX, 1951). Peso de la pieza extirpada 80 grs. Resultado: Curación en 1953. B.K. negativo. Orina del riñón izq.: Algunas celulas pavimentosas; escasos leucocitos; escasos hematies; B.K. negativo.

*Obs. 9* (54) I.M. Varón de 44 a. (Fig. 2*C*.). Diagnóstico: Tuberculosis renal bilateral. B. de Koch, positivo. Tratamiento: Nefrectomia lumbar der. a los 44 a. (1943). 75 grs. Estreptomicina y resposo pre-operatorio. Resección polo inf. izq. a los 52 a. (1951). 10.5 grs Estreptomicina y reposo post-operatorio. Peso de la pieza extirpadaa 70 grs. Azotemia post-operatoria de 4 grs %o; fistula urinaria lumbar durante 4 meses. Resultado: Curación en 1953. B.K. negativo: reincorporado al trabajo. Orina por sonda lumbar izq. Albumina: 0.25 gr. %o; Urea; 10.50 gr. %o; escasas celulas epiteliales; algunos leucocitos; escasos hematies; algún cristal de oxalado de cal; B.K. negativo.

*Obs. 10* (55) J.C. Varón de 31 a. (Fig. 2*D*.). Diagnóstico; Tuberculosis riñón izq. B. de Koch, positivo. Tratamiento: 12 grs. de Estreptomicina y reposo pre-operatorio. Resección polar sup. izq. (XI, 1951). 7 gramos Estreptomicina post-operatorio. Peso de la pieza extirpada 72 grs. Resultado: Curación; en 1953 B.K. negativo.

*Obs. 11* (56) C.P. Mujer de 24 a. (Fig. 2*E*.). Diagnóstico; Tuberculosis riñón der. B. de Koch, positivo. Tratamiento: Solo reposo pre-operatorio. Resección polo sup. der. (XI, 1951) —4.5 grs Estreptomicina post-operatorio. Peso de la pieza extirpada 85 grs. Resultado: Curación; en 1953. B.K. negativo.

*Obs. 12* (58) A.M. Mujer de 22 a. (Fig. 2*F*.). Diagnóstico: Tuberculosis riñón der. B. de Koch, positivo. Tratamiento: Solo reposo pre-operatorio. Resección polo sup. der (IV, 1952). 17 grs. Estreptomicina post-operatorio. Peso de la pieza extirpada 42 grs. Resultado: Curación; en 1953 reintegrada al trabajo.

*Obs. 13* (62) T.C. Mujer de 38 a. (Fig. 3*A*.). Diagnóstico: Tuberculosis renal der. B. de Koch, positivo. Tratamiento: 23 grs. Estreptomicina pre-operatorio. Resección polo sup. riñón der. (XII, 1952). 13 grs. de Estreptomicina post-operatorio, reposo. Peso de la pieza extirpada 35 grs. Resultado: Curación; en 1953 B.K. negativo; ha engordado, sigue cura de reposo.

*Obs. 14* (63) A.G. Varón de 18 a. (Fig. 3*B*). Diagnóstico: Tuberculosis uro-genital B. de Koch, negativo. Tratamiento: Epididimectomia por caseosis tbs. a los 18 a. (1947). 15 gramos Estreptomicina y reposo pre-operatorio. Resección caverna tuberculosa polo sup. riñón der a los 23 a. (1952). 15 grs de Estreptomicina y reposo post-operatorio. Peso de la pieza extirpada 40 grs. Resultado: Curación; B.K. negativo. Ha engordado; sigue cura reposo. Orina del riñón der. Urea 6.50 gr. %o; algunas celulas epiteliales; muy escasos hematies; B.K. negativo.

*Obs. 15* (65) P.V. Varón de 31 a. (Fig. 3*C*.). Diagnóstico: Tuberculosis genito-urinaria. Exclusión polo sup. riñón izq. B. de Koch, positivo. Tratamiento: Epididimectomia a los 32 a. 40 grs. Estreptomicina y reposo pre-operatorio. Resección polo sup. izq. (I, 1953). 32 grs. Estreptomicina y reposo relativo post-operatorio. Peso de la pieza extirpada 37 grs. Resultado: B.K. negativo; gran mejoria del estado general; orina limpia, has engordado; sigue cura de reposo.

*Obs. 16* (66) M.L. Mujer de 28 a. (Fig. 3*D*.). Diagnóstico: Tuberculosis polo inf. riñón der. B. de Koch, positivo. Tratamiento: 35 grs. Estreptomicina y reposo relativo pre-operatorio. Resección polar inf. der. (I, 1953). 6.5 grs. Estreptomicina post-operatorio. Peso de la pieza extirpada 90 grs. Resultado: Curación B.K. negativo; ha engordado, buen estado gegeral; reintegrada a sus labores. Orin riñón der. Albumina: 3.50 gr. %o; Urea: 14 gr. %o; bastantes celulas epiteliales, escasos leucocitos; bastantes hematies, escasos colibacilos; B.K. negativo.

*Obs. 17* (67) E.I. Varón de 25 a. (Fig. 3*E*.). Diagnóstico: Tuberculosis ulcero-cavernosa *polo sup. riñón der. B. de Koch, positivo.* Tratamiento: 90 grs. Estreptomicina pre-operatoria. Resección polo sup. der. (I, 1953). 30 *grs Estreptomicina post-operatoria. Peso de* la pieza extirpada 36 grs. Resultado: Curación; B.K. negativo.

*Obs. 18* (68) M.P. Mujer de 22 a. (*Fig. 3F.*). Diagnóstico: Tuberculosis ulcerosa cáliz sup. riñón der. Tratamiento: 50 grs. Estreptomicina y reposo pre-operatorio. *Resección polo* sup. der. (III, 1953). 43 grs. Estreptomicina post-operatoria. Peso de la pieza extirpada 42 *grs. Resultado: En Obsservación;* la herida operatoria cura por segunda intención% B.K. negativo; sin piuria; sigue con reposo. Orina del *riñón* der. Albúmina: 0.15 %o; urea 15 gr. %o; algunas celulas epiteliales, Escasos leucocitos; escasos hematies, B.K. negativo.

*Obs. 19* (69) M.C. *Mujer* de 57 a. (Fig. 4A.). Diagnóstico: Tuberculosis urinaria bilateral; exclusión renal der; exclusión polo sup. riñón *izq.* B. de Koch, *negativo.* Tratamiento, Nefrectomia der. (III, 1953). Resección polo sup. izq. (IV, 1953). En tres ocasiones que tomo Estreptomicina se abandono por intolerancia (fiebre). Peso de la pieza extirpada 35 grs. Resultado: Curso post-operatorio; salió orina por la herida durante unos dias cerrando a los 20 dias de operada. Curación *por segunda intención B.K. negativo. Em observación.*

*Obs. 20* (70) R.R. Varón de 33 a. (Fig. 4*B*.). *Diagnóstico: Tuberculosis renal bilateral.* Exclusión riñón der, caverna calicilar excluida polo inferior riñón izq. B. de Koch negativo. Tratamiento: Nefrectomia polar inferior izquierda (V, 1953) Estreptomicina. Peso de la pieza extirpación 35 grs. Resultado: Exitus a las 7 horas de la intervención en cuadro de toxi-infección tuberculosa (hiperpirexia a 41°).

*Obs. 21* (73) F.S. Varón de 42 a. (Fig. 4*C*.). Diagnóstico: Tuberculosis urogenital; exclusión polar inferior izquierdaa. B.K. negativo. Tratamiento: Resección polo inferior izquierdo (VI, 53). Peso del fragmento extirpado 30 *grs. Resultado: En observación.*

*Obs. 22* (74) J.E. Varón de 31 a. (Fig. 4*D*.). Diagnóstico: Tuberculosis urinaria; caverna calicilar polar superior *riñón derecho.* B.K. positivo. Tratamiento: 19 grs de Estreptomicina; tratamiento tónico y reposo pre-operatorio. Resección polar superior der (VI, 1953). Peso del fragmento extirpado 45 grs. Resultado: En observación.

RESUMEN

| | |
|---|---|
| *Enfermos operados de nefrectomia parcial* por tbs. | 22 |
| N.P. En riñon unico (Obs. 2, 9 y 19) | 3 |
| N.P. *con riñon opuesto tbs. excluido (Obs.* 20) | 1 |
| Supervivencias post-operatorias | 21 |
| Muertes post-operatorias (*Obs. 20*) | 1 |
| Muertes lejanas (Obs. 2) | 1 |
| Enfermos sometidos a intervencion posterior (Ureterectomia extravesical) (Obs. 6) | 1 |
| Operados en 1943 | 1 |
| Operados en 1947 | 1 |
| Operados en 1948 | 1 |
| Operados en 1949 | 1 |
| Operados en 1950 | 2 |
| Operados en 1951 | 5 |
| Operados en 1952 | 3 |
| Operados en 1953 | 8 |
| Peso total tejido renal extirpado | 1.127 grs. |
| Peso medio tejido renal extirpado | 56.35 grs. |

*RESULTADOS*

| | |
|---|---|
| Buenos<br>Obs. 1, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19. | 15 |
| Regulares<br>*Obs. 2, 3, 4. 6.* | 4 |
| Malos | 1 |
| Nefrectomia secundaria | 0 |
| *Supervivencias*<br>Máxima 10 años; Minima 4 años | ... |
| En Curso | .... |

CONCLUSIONES

1. Merced a la tendencia actual de postergar a *previo* tratamiento [illegible] y reposo, la "nefrectomía *precoz* [illegible]" con frecuencia se observa la [illegible] en el riñón de la lesiones [illegible] conservando el resto su *integridad* [illegible] largo tiempo.

2. La facilidad y *prodigalidad* [illegible] urográficos por [illegible] sin riesgo *ni* [illegible] seguir la evolución [illegible] tuberculosas en el [illegible] la oportunidad de las [illegible] conservadoras.

2. Si la lesión [illegible] está estabilizada

conserva buena irrigación y las vias urinarias están expeditas, la N.P. puede ser practicada.

4. En caso de riñón único con lesiones limitadas, el resto del parenquima sano y buen estado general, la N.P. es el único medio de que se dispone para preservar a este resto de riñón de la invasión tuberculosa.

5. Para completar la N.P. debemos aprovechar los beneficios de las drogas actuales si son bien toleradas y en especial ayudar el pre y post-operatorio con tratamiento general tonificante y en especial reposo a ser posible sanatorial.

6. A medida que se avanza en la precisión diagnóstica y en la técnica quirúrgica la exéresis de la parte dañada del riñón tuberculoso estará más indicada tanto para la extirpación de las cavernas como para eliminar lesiones residuales o curativas con fibrosis que afectan la función de la porción del riñón indemne.

7. Los resultados obtenidos no guardan exacta relación con los antibióticos ni las dosis utilizadas; si bien es evidente que con estas drogas y el reposo se ha facilitado la estabilización de la lesión e incluso su regresión, lo cual justifica la indicación de N.P. en lugar de la exéresis de todo el riñón, que parecia indicada al comienzo de la infección.

◆

Democracy was invented as a device for reconciling government with liberty. It is clear that government is necessary if anything worthy to be called civilization is to exist, but all history shows that any set of men entrusted with power over another set will abuse their power if they can do so with impunity. Democracy is intended to make men's tenure of power temporary and dependent upon popular approval. In so far as it achieves this it prevents the worst abuses of power. The Second Triumvirate in Rome, when they wanted money with a view to fighting Brutus and Cassius, made a list of rich men and declared them public enemies, cut off their heads, and seized their property. This sort of procedure is not possible in America and England at the present day. We owe the fact that it is not possible not only to democracy, but also to the doctrine of personal liberty. This doctrine, in practice, consists of two parts, on the one hand that a man shall not be punished except by due process of law, and on the other hand that there shall be a sphere within which a man's actions are not to be subject to governmental control.

—*Russell*

# Instrumental Para Cirugia Vascular
## Flebodisector

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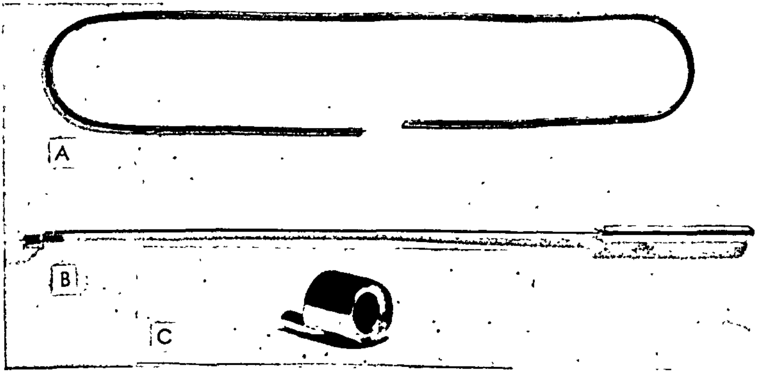
EL instrumento ideal que procure la fleboextracción perfecta en las resecciones subcutáneas de la vena safena, no ha sido alcanzado todavía. Los usados actualmente adolecen de defectos: dificultades en la progresión dentro de la luz venosa, perforación en las sinuosidades, arrancamiento incompleto, desgarro de la vena, intenso traumatismo. Presentamos un instrumento que asocia el cateterismo del vaso con la disección cortante exterior, mediante la combinación del uso de dos piezas. Antes queremos resumir en un cuadro los principios generales en que están basados los procedimientos de fleboextracción, conocidos, omitiendo, en homenaje al espacio y por ser de manejo habitual en los cirujanos, su descripción detallada.

*Fleboextracción externa.*—1. Aro romo enucleador rígido, o enucleador y fórceps (Mayo, Shermann). Procede por disección roma externa, sin cateterismo de la vena.

*Fleboextracción interna.*—2. Tallo flexible con oliva. Procede por arrancamiento con invaginación de la vena (Babcock, etc.). 3. Tallo flexible con oliva de progresión intercambiable por un tope. Procede por arrancamiento sin invaginación (Finochietto-Giménez, etc.). 4. Tallo elástico espiral (Strippers Myers spiral), con olivas de varios diámetros, cónicas, intercambiables. Procede también por arrancamiento sin invaginación.

*Fleboextracción combinada.* — 5. Tallo flexible, con oliva de progresión intercambiable por un cilindro fenestrado, con borde de ataque cortante. Procede por corte externo y arremangamiento de la vena cobrada en el receptáculo (Esperne, del Servicio R. Finochietto). 6. *Flebodisección*: Espiral guía de acero inoxi-



*A* and *B*, espiral y mango portacilindro armado. *C*,

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dable o cromado, que constituye un tallo flexible y elástico de 85 cms., con pequeña oliva fija de progresión en ambos extremos (Fig. 1 *A*). Pieza activa que consiste en un anillo o cilindro con borde de ataque cortante, montado en un mango rígido (Fig. 1 *B*) de 40 cm. de long. (portacilindro). El anillo disector tiene dos diámetros: 10 y 12 mms. y una sola longitud: 20 mm. (Fig. 1 *C*). El eje de empuje del mango está centrado en la luz del cilindro por una rosca convenientemente inclinada. Mango, pieza intermediaria y anillo se independizan para comodidad de esterilización. Procede por disección cortante externa, con guía espiral rectificadora interna. Este instrumento fué presentado en la Sección Cirugía Vascular del Séptimo Congreso Internacional de Cirugía, celebrado en Bs. As., Agosto de 1950, por el Colegio Internacional de Cirujanos. Pasamos a detallar el manejo del instrumento presentado.

La espiral-que es no sólo elástica, sino flexible—acomoda mejor que los comunes tallos elásticos, pero semirrígidos, a las sinuosidades de la vena. (excepto el Myers). La progresión de este catéter alcanza así distancias mayores, sin peligro de perforación, pues antes que atravesar la pared, se dobla. La introducción de esta espiral puede hacerse desde la ingle, una vez terminado el primer tiempo de resección del cayado y sus confluentes, o desde cualquier altura de la pierna en sentido retrógrado. Llega un momento en que la espiral, como cualquier otro catéter, hace imposible su progresión, por lo que es necesario aflorarla en ese sitio mediante una nueva incisión. Exteriorizada entonces, el ayudante la mantiene tensa por ambos extremos, lo que "rectifica" en el subcutáneo el trayecto tortuoso de la safena y permite con una larga aguja y jeringa de pico metálico, hacer a su alrededor la anestesia local del trayecto, para proceder a una disección indolora. Significamos aquí que en aproximadamente 400 safenectomías, no hemos usado otra anestesia que la local, o locoregional con novocaína (procaína) al 1% y 0.50%, con resultados satisfactorios. Conseguida la anestesia perivenosa gracias a la guía, actuamos ahora con el segundo instrumento, el anillo o cilindro disector (Fig. *C*) solidarizado a rosca en su conductor. Este anillo-de dos diámetros-lleva en su interior, a dos milímetros del filo, un aro romo, destinado a aplastar la vena sobre la espiral, haciendo que la pared de ésta se aleje del borde cortante, y actúe sobre los tejidos perivenosos y las colaterales; evita también que el filo roce con la espiral y se melle.

Una vez enhebrados vena y catéter en el cilindro, el ayudante por un extremo y el cirujano por el otro, mantienen tensos los extremos de la espiral y con la mano libre manejando el mango conductor, se diseca aquélla con movimientos circulares incompletos y cortos, haciendo progresar lenta pero firmemente la pieza cortante por el túnel que va labrando en el subcutáneo, siguiendo la guía que representa la espiral. La vena es así prácticamente "pelada," sin brusquedades, sin arrancamientos, ni violencias, labrando un túnel mínimo. El cirujano queda con el ánimo de haber extraído la vena mediante una maniobra quirúrgica y delicada. A veces el encuentro con una gruesa colateral puede provocar el arrancamiento por dislaceración del tronco principal, pero prosiguiendo la maniobra, aunque en más de un pedazo, hay la seguridad de que la vena sale toda.

## RESUMEN

Se presenta un instrumento para extraer la vena safena con el mínimo traumatismo, que consiste en una espiral de alambre de acero inoxidable o cromado, con pequeñas olivas en sus extremos y un cilindro disector, cortante, montado en un tallo rígido con mango, de 40 cms. El cilindro disector tiene dos diámetros: uno de 10 mm. y otro de 12 mms. y en su interior un aro romo para comprimir la vena contra la espiral, cuando ambos instrumentos trabajan juntos en la disección de la vena.

# Editorial

## Semmelweis and the Struggle for Truth

> The farther off we place our aim and the less we desire to be ourselves the witnesses of what we have laboured for, the more wide and rich will be the measure of our success—men cannot benefit those that are with them as they can benefit those who come after them. All the short, and cheap, and easy ways of doing that whose difficulty is its honour—are just so many new obstacles in our already encumbered road. They will not make one of us happier or wiser—they will only make us shallower in our understanding, colder in our hearts and feebler in our wits. And that most justly.—*Ruskin.*

I. *The Fight for Knowledge.*—My visit to Vienna last year was of the nature of a pilgrimage, for in the early days of my training in Public Health, my chief, the late Sir John Robertson, told me in his inimitable manner of the work of Semmelweis and this had so impressed me that I had always the urge to learn more about the man who had done so much for humanity. Consequently one of my first visits was to the university where he had been lecturer in obstetrics. I asked there if there was any memorial to Semmelweis and I was directed to the colonnade which surrounds three sides of a great quadrangle. In it I found multitudinous busts of the illustrious doctors of the Vienna medical school. I searched there most carefully three times as I walked around the quadrangle, but I could find no reference of any sort to Semmelweis. I met many students and enquired of them but none could tell me anything about him; they said I should find a memorial amongst the others; hence the three searchings.

Eventually I was fortunate in finding a man who directed me to the General Hospital, the Allgemeine Krankenhaus, where Semmelweis had worked in a clinic. On entering the grounds of this famous hospital I came face to face with a striking and larger than normal statue in white marble of Billroth, a surgeon famed for his surgery of the stomach, but though I enquired of many men it was a long time before I could get light on Semmelweis. At last I met a surgeon who said he was sure there was a memorial somewhere and he would try to find out where it was. When he returned he escorted me to the grounds of another group of hospital buildings, and there between two blocks was a large bronze plaque mounted on marble. One had to get close to read his name—Ignaz Philipp Semmelweis 1818-1865. I photographed the memorial, which had been erected at the cost of two friends, as a reminder of the search.

The story of the life of this great man has a message even at the present day. He was born of well-to-do parents in Ofen, Budapest; he was the fourth of eight children, had attended school there, in Pest, in Buda and in Vienna, and in 1844 he had qualified as a doctor in Vienna. Two years later he became a Doctor of Surgery. In his student days he came under the influence of Rokitansky, the leading pathologist in Vienna, to whom he attributed much. Now at the age of 28 years he was appointed as assistant to Dr. Klein, Professor of Obstetrics in the university.

Dr. Klein was a man of great personal charm and ability, which gave him considerable influence with the authorities; he was jealous of his position and rigorously followed the orthodox methods in his teaching. He established two clinics, one for the training of doctors and medical students, the other for the training of midwives and at that time Vienna was a famous school to and from which men came from all parts of the world.

Semmelweis w [illegible]

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sidered it his essential duty to help suffering humanity, rather than as a scientist to be ruled by established dogma and in this he differed from his chief and most of the other doctors on the staff. Consequently it was not long before he was faced with the knowledge that many healthy young women who came to the clinics to have their babies died of child-bed fever. As many as 14 per cent suffered this fate in some years. This finding was a source of great grief to him and caused him carefully to investigate the disease. He learnt the views of the scientists which had been gradually built up through the centuries; not only those which Paracelsus had stressed, i.e., the stars, poisons, heredity, the mind and the afflictions of God, but the conditions to which the modern scientists ascribed the cause, i.e., overcrowding, bad ventilation, atmospheric and weather conditions, effluvia and exhalations, altered conditions of the blood, individual predisposition, neglect of purgatives, promiscuous sexual excesses and fear.

The fear was induced by the general knowledge of the great death-rate in pregnant women at childbirth and by witnessing the distressing deaths of co-patients who had come in but a few days before apparently healthy, but there was also a fear of the doctors. The latter had a more solid foundation than the patients knew, though it had become well known that the death-rate was at least twice as great in the clinic where the doctors were trained than in the clinic for the midwives. Semmelweis had seen women beg and pray to be removed from the former. The distress of these women and their subsequent death along with very many others and the analyses of the deaths aroused his deepest emotions and heart-felt compassion.

The teachings of the orthodox he studied desperately, but they gave him no solution to the problem so he pushed them aside, for he was dominated by his emotions and mission to help his patients. The disparity in the death-rate of the two clinics was so conspicuous that he determined some important difference existed between them. The obvious difference was that which had escaped attention because it was the universal orthodox practice. In the clinic for the doctors and medical students all the pregnant women were examined by the doctors and students who also did something else; they conducted the post-mortem examinations and with their soiled hands stinking and filthy from the handling of the dead bodies, they went into the clinic and examined the vital structures of the patients. Most of those in whom labour was protracted died. They received repeated examinations, whereas those who delivered themselves before the doctor arrived usually escaped child-bed fever, as did those who were treated at home.

Semmelweis was an individualist who was not obsessed by scientific dogma and this evidence convinced him that he had divined the main cause of the trouble. At once with all the vigour his emotions had aroused, he began his attack on the orthodox methods employed in the teaching schools. He preached that which seemed obvious to him, namely, that before any doctor or student, who had assisted at a post-mortem, examined a woman he should thoroughly purge his hands in chloride of lime, the most efficient disinfectant known in that age of 1847.

Professor Klein, his chief, had allowed Semmelweis to continue with his work as long as it was within the quiet of his department, but he became very annoyed and embittered when the discovery of Semmelweis became known outside his department of the university because already the authorities had become alarmed at the publicity of the death rates. Klein was vexed because Semmelweis was drawing attention to the fact that the deaths were due to him and the students taught by him. He regarded it as a slur and a condemnation on him and all other leading professors. Jealousy, mental impotence, shortsightedness and perhaps an inner recognition of his responsibility for many of the deaths in his clinic caused him to exercise his overwhelming influence with the university authorities against Semmelweis.

Semmelweis had been able to convince a few important doctors. Professor Skoda, a leading physician, gave him his support, but with others who did so he suffered boycott and the other inconveniences which accompany it. His strongest supporter was Professor Michaelis, of Kiel, but he died a tragic death soon after. He had attended a beloved cousin in her pregnancy and she had died of puerperal for which he blamed himself since he had made his examination of her after doing a post-mortem. He became melancholic and threw himself in front of a train. Semmelweis learnt much also from the death of another friend, Prof. Kolletschka, a pathologist. He had pricked his finger during a post-mortem examination and died within a few days of septicæmia.

This illness and death of his friend created a great impression on Semmelweis for he noted that the disease ran a similar course to that of puerperal fever and the lesions at death were similar. He also noted from the infection and death of other patients that women could be infected from the hands, instruments, dressing and clothing which had been soiled during the examinations of patients with discharging wounds and therefore it was not only poison from dead bodies that could destroy other lives. These events, coupled with the statistics which he had collected had a profound influence on the humanitarian.

II. *The Fight Against Obscurantism.*—Semmelweis was not a good lecturer; he was not a good writer; it was said he hated writing, but what he wrote he wrote with his heart's blood, for it was directed by emotions aroused by the unnecessary multitudinous deaths of young women. His manner was brusque; he could not feign what he did not feel. He did not hesitate to confess his errors. He was strictly truthful and honest. He hated lies and dishonesty and he told the truth though it brought him disfavour. He found it more difficult to exterminate an old lie than to introduce a new truth. He attacked his enemies with a sledge-hammer rather than with a rapier, and this made it difficult for them to retire. He was an independent thinker activated by his zeal for the welfare of his patients and he watched over them with vigilance to protect them from anyone or anything which would do them harm. But recognizing his severe disadvantage against the orthodox opinions, which were all in conformity with those of the teachers in the medical schools, he left it to his friends to write, since he considered they had the greater ability with the pen. Consequently he was blamed because he did not propagate his ideas more widely in the medical Press.

He had spent so much time in trying to establish his findings that he had not developed a lucrative practice. His opponents intentionally denied and distorted his claims. They were neither sincere, frank, nor honest in their criticism. The leaders in the medical schools belittled the teaching of Semmelweis; they adopted a common method of attack, i.e. he was riding a hobbyhorse in continually insisting that a little material on the hands from a dead body could cause puerperal fever. Had they not all studied the disease in the light of all the knowledge provided by the scientists, and was it not stupid to insist on condemning that which all the leaders did? Some questioned if Semmelweis had contributed anything to their knowledge of the cause. Others denied the value of chloride of lime and considered that it was unreasonable to insist that doctors and students wash their hands in it. Some went so far as to say that with its use they had not checked puerperal fever and that deaths occurred in women who were not examined. They provided a negative answer to all that Semmelweis claimed. They sought to distract attention by blaming the infection on the foreign students and prohibited their attendance on patients in the wards.

In other words, the leaders in the medical schools scrutinized with infinite diligence and gave undue credence to any trifling evidence which could tell against Semmelweis, but they shut their eyes and were blind to the strong evidence of the common senses. They preferred not to see that with the introduction of these m[illegible]ods into the clinic [illegible]nd idly decreased. In May, 1847, Semmelweis insisted that all doctors and students should wash their hands in chloride of lime. In that month, of 294 pregnancies no fewer than 36 (12.4 per cent) died, but in the next seven months of 1,841 pregnancies only 56 died, i.e. 3.04 per cent. In the first year the death-rate was reduced to 5 per cent in the doctors' and students' clinic, but the midwives' clinic had only a .9 per cent mortality—this he believed to be due to the disbelief of the efficacy of his methods and the consequent carelessness with which the doctors used them. They did not apply the thoroughness which Semmelweis demanded.

Encouraged by his friends, Rokitansky and Skoda, he published his findings and wrote to the leading professors in other countries. He lectured in London in 1848. Some acknowledged the great importance of his work, but his stronger enemies constantly repeated the criticisms which he had amply proved to be false and, though they could be excused for subjecting his new ideas to the severest criticism, their behaviour in the face of clearly established proofs exasperated the emotional Semmelweis, who was already so distressed by the thousands of deaths which their teachings caused. They clearly indicated the meaning which Goethe conveyed when he stated that by giving honours to others we deprive ourselves of our own nobility.

Frustrated and embittered, Semmelweis left the Algemeine Krankenhaus in March, 1849. He applied for a lectureship in obstetrics at the university but was turned down. He later applied again, and after a delay of eight months he was appointed, but with serious limiting restrictions on what he should teach. Then, as now, the professors claimed a right to veto and restrict the works and teachings of any who come within their sphere of influence no matter how ignorant or intolerant they themselves may be in such matters. So-called science is too frequently allowed to dominate things of the spirit, consequently humanitarianism must suffer. So deeply was Semmelweis wounded that he lost all hope of getting his truths accepted and he left Vienna and returned to Bu

But though his teaching was s
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even into the practice of his enem
signs of his victory. As impercept
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his cause a great deal of harm, an
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India had aroused interest in Eng
his teaching he took up the fight
the more vigorously because he fe
his silence had cost thousands of
and children their lives, since the
sors had continued their death-
practices for the education of docto
students from all lands.

On May 20, 1850, he was appointe
of obstetrics at Budapest and rema
charge for six years. Of 930 pr
women in labour only eight we
though the condition of his clinic w
poor. It was on the second floor a
offensive smells from the sewer a
post-mortem room below made it
intolerable. Further, the patients'
ing, the bedclothing and the dressi
ceived scant and insufficient attenti
laundry work was of the worst ord
there were no means of isolating i
cases. Knowing that all these thing
highly prejudicial to his reputation
teachings, he fought vigorously
change in the sanitary conditions
clinic but was wholly unsuccessfu
forbade any student to enter the wa
had been in the post-mortem room
refused to have anything to do with
students who did not scrupulously
his rules.

In 1855-6 among 540 cases of lab
had only two deaths. His fight agai
obscure dogmas was intensified;
pealed to the Press. He was unsucc
in obtaining the vacancy of Profes
Obstetrics at Prague, but he refused

offered him at Zurich. In 1856 he married the daughter of a very rich Budapest merchant and from this time onward he published a number of papers, and in this way improved his attack. Epidemics of puerperal fever in Würzburg, Strasbourg and Munich occurred, but still the responsible professors would not accept the teaching of Semmelweis. He urged Government action to introduce laws which would prevent infection of women by those whose duty it was to protect them.

Semmelweis grew more and more exasperated with the dishonest and insincere opposition against him. He wrote open letters to the leading opponents, but his uncontrolled letters written only in desperation increased the enmity against him. This created a vicious circle in which his aggressiveness was more and more fierce, until he came to accuse of murder those who refused to teach the truth, since they influenced the young to do those things which would bring death to the patients. His lectures became more and more impassioned. He was sometimes so carried away with his ardour for the truth that he dissolved in tears and could not continue. His wrath was kindled at examinations by students who had failed to grasp the importance of his teaching. In July, 1865, he broke down completely under the mental anguish, and on July 20 he was taken to a mental home in Vienna where he died in August, 1865, at the age of 47. At the post-mortem it was found that the cause of his death was pyæmia from infection he had contracted in the middle finger of his right hand during an operation on a newly-born baby. It is remarkable that this man who had fought so hard to save women from implanted infection should have died from such an infection.

His life had not been in vain—already surgeons had become conscious that his teaching was the truth and though they denied him any credit they quietly altered their methods, and when Pasteur, 30 years after Semmelweis, had made his discovery and had explained that infection was through the agency of living micro-organisms they insidiously adopted Lister's methods as a mere extension of their common practice.

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My thanks are due to Prof. E. Zdansky, University of Vienna and Drs. A. W. Bauer, Kasper Blond and J. Horne, formerly of Vienna, who assisted me in my researches and with translations.

* * *

It is just as well that justice is blind; she might not like some of the things done in her name if she could see them.

Every man loves justice at another man's house; nobody cares for it at his own.

He does not believe that does not live according to his belief.

—*Anonymous*

# New Books

**Cancer: Problemas Clínico-terapéuticos.** By Manuel Riveros M. in colaboratión with other authors. Madrid: Editorial Paz Montalvo, 1953. Pp. 534, with 502 illustrations, 33 in color.

Eighteen papers are here presented, covering a general review of malignant disease in various manifestations. It is pointed out, however, that the volume is not intended to constitute a formal treatise on cancerology, as it refers solely to diverse localizations of neoplasms personally observed by the authors. Nevertheless, the high quality and comprehensiveness of the total collection recommend it as an invaluable adjunct to any systematic study. It is the further intention of the authors to present their experience in a form which will be useful to the busy general practitioner. Finally, the surgeon and roentgenologist will here find a mine of original case material, full documentation, superb graphic presentation and careful discussion of therapeutics.

An outstanding feature of this book is the profuse illustrative material, including histopathologic, clinical and roentgenologic. This should serve to make the volume a "must" in any large collection on neoplasms. Particular praise is reserved for the colored plates by Dr. Reuben A. Teixido, which include some of the finest and most instructive examples of the photographer's art yet seen. These plates all represent cases from the Tumor Clinic of the Instituto de Cirugía, Asunción. They include both clinical and pathologic specimens.

The papers themselves show considerable variation in length and treatment. Those in more formal style include reviews of the history and literature of the entity, as well as bibliographies. The longest, on radiology in relation to maxillary tumors, contains a detailed classification of these neoplasms. Some of the shorter papers, however, which present rare or unusual tumors, are also outstanding, with some of the most striking documentation. Such, for example, are the fine presentations on familial polyostotic osteodystrophy, as well as those on adimantinomas. Preference will depend on the interest of the individual reader, since all members of the international panel of authors are of recognized authority.

While all the papers are in Spanish, the value of the material is such that it will probably find a place in collections that do not specialize in that language.

MAX THOREK, M.D.

**Low Back Pain and Sciatica.** By Louis T. Palumbo. Philadelphia; J. B. Lippincott Co., 1954. Pp. 104, with 34 illustrations.

Here is a standard subject presented in a routine, orderly fashion, beginning with basic anatomic considerations and progressing through etiologic factors, diagnosis, and treatment. By far the greatest part of the text deals with the intervertebral disc, since, as is made apparent in the introduction, this is by far the most common cause of low back pain. The material is presented in such a fashion as to make for easy reading and full understanding. A profuse bibliography provides the reader with many excellent references if further detailed study is desired.

A monograph of this kind is of much value to the general practitioner. It will provide him with the proper approach to the sometimes very difficult syndrome of low back pain.

ALLAN B. HIRSCHTICK, M.D.

**Seventy-five Years of Medical Progress, 1879-1953.** Edited by Louis H. Bauer. Philadelphia: Lea & Febiger, 1954. Pp. 286 Ports.

This concise, convenient volume presents a view of medical practice and its recent advances as seen through the eyes of leading members of the profession in America. It originated in a set of papers prepared for the First Western Hemisphere Conference of the World Medical Association and was designed to represent the nineteen recognized medical specialties plus general practice.

The result is a happy one. The distinction of the contributors alone would entitle their opinions to more than passing notice. For example, if one is seeking a bird's-eye view of surgical progress, he can find under one cover essays on anesthesiology by Beecher, proctology by Hirschman and surgery by Blalock and DeBakey. It is the pride of preparation and high quality of thought, however, that give the volume its true value as a book of reference, no less than of inspiration. Although the papers are synoptic, as they should be, a number include extensive documentation. Others, like Dr. Bartemeier's contribution on psychiatry, are concerned with changing attitudes of the profession toward a given specialty.

A contribution of such high historical value marks an auspicious beginning for a new world medical fraternity. It is perhaps a pity, therefore, that only American contributors are included, even though their outlook is true to the university of the healing art. Still, we miss the peculiar *aperçus* of other national schools and the more genuine international flavor they could impart.

The bulk of this printing is to be presented to the graduates of American medical classes of 1954. While this is commendable, it will be regretted that the plan will leave only a limited number of copies for sale to the lay and professional public.

MAX THOREK, M.D.

La Chirurgie à Deux Equipes dans le Traitement des Cancers Pelviens (Two-Team Surgery in the Treatment of Pelvic Cancers). By A. Ameline, J. Huguier, P. Moyse, and Y. Chatain. Paris: Librairie Arnette, 1950. Pp. 160. Illustrated.

A simultaneous abdominal and perineal approach in pelvic intervention is the procedure advanced in this concise monograph. Such a synthesis would seem to be inevitable in view of the incontestable advantages of each of the approaches, so well known to experienced abdominal surgeons. Alternatives in the past have included the several mixed approaches, as well as multistage operations in which abdominal and perineal approaches are used consecutively. The simultaneous approach has not been overlooked, of course; it was used in Japan as early as 1923.

The present volume is concerned chiefly with the operative technics developed by the authors since 1918. Short theoretical and anatomic discussions present the rationale of these procedures in a concise and readable form that makes for quick and easy comprehension.

The contents are limited to three types of intervention: (1) operation for rectal cancer, (2) radical colpohysterectomy and (3) radical cystectomy. In the rectal section, the two types of procedure are amputation and resection. Technics are described in detail for male and female, and amputation in the female patient is given both with and without hysterectomy. An introductory anatomic section describes the surgical sheath and appendages of the rectum, illustrated with drawings and embryologic sections. The conclusion is that double-team intervention assures more thorough ablation of the cancerous rectum in its entirety, together with its sheath, as well as proper hemostasis and adequate excision of the rectal appendages. The double approach also minimizes shock due to changes in the patient's position; facilitates exploration and the decision between resection and amputation; makes for freer procedure with direct visualization of both hemostasis and operation; allows easy and strict peritonization, and obviates all bone resection. It is suggested that the double approach may also be useful in colorectoplasty.

The section on colpohysterectomy is presented in similar fashion, the detailed account of technic following an anatomic review. In discussing the double-team approach to gynecologic procedures, the authors point out that they do not consider it a high approach with an accessory perineal approach, but a low approach with the convenience and security of a high approach. They also include a list of their own expanded indications for operation in cases of uterine cervical cancer and cancer of the corpus uteri, even reporting cures of Stage IV cancers extending to the bladder or rectum. In view of the facility of procedures with the double approach, they also counsel against attempting to operate on tumors that are too far advanced.

The chapter on cystectomy is the contribution of Drs. Michon and Delinotte, who emphasize the fact that the double approach greatly enhances facility in various urologic procedures. They even resort to the phrase "*facilité dérisoire*" in referring to the Goebel-Stoeckel operation for urinary incontinence.

It remains to call attention to the profuse technical drawings of M. Delpech, to which the book owes a major part of its effectiveness.

This is a book that will richly repay careful study on the part of abdominal and gynecologic surgeons.

MAX THOREK, M.D.

**Cesarean Section; Another Technic of Low Cervical with Extraperitoneal Drainage,** Vise, G. T.: South. M. J. 47:293, 1954.

There are four types of cesarean section in use today: (1) the classic; (2) the low cervical; (3) the extraperitoneal, and (4) the cesarean hysterectomy. To these the author adds a fifth, which he describes as a low cervical section with extraperitoneal drainage and which, in his opinion, will fill all needs and largely replace the extraperitoneal and the cesarean hysterectomy.

His method is a transperitoneal low cervical section with a puncture wound through the lower uterine segment. The lower segment is opened transversely with the index fingers without cutting the lower uterine segment. After delivery of the fetus and closure of the lower uterine wound, an extraperitoneal penrose cigarette drain is easily inserted through the vesical space.

In those cases in which Dr. Vise is certain that a delivery from below cannot be accomplished, he tries to do the section as near the time of delivery as possible. He follows his patients by repeated vaginal examinations and does the cesarean sections when the cervix is thinning out and beginning to open.

Patients not definitely requiring cesarean section should have a given trial labor. The over-all high rate of cesareans will be lowered only when the physician himself knows that he can safely do a section late in labor in a case of infection or potential infection. Trial labor should be true labor, with good pains at regular intervals, growing progressively stronger and closer together. A trial labor is not complete unless the membranes rupture, or are ruptured artificially when the cervix has almost fully dilated.

The author prefers spinal anesthesia and also likes local and caudal which he feels are safe for the baby. He prefers ether for general anesthesia.

In his opinion the advantages of his modified low cervical cesarean section with the use of an extraperitoneal drain are as follows:

"1. It is easy to do.
2. It is almost bloodless as far as cesareans go.
3. It helps prevent peritonitis and cellulitis.
4. There is less need of blood transfusions. This is especially advantageous to the Rh-negative woman.
5. There is less chance of bladder injury than in extraperitoneal sections.
6. There is less chance of ureteral injury than in extraperitoneal sections.
7. Delivery is easy and there is time to give needed attention to the resuscitation of the infant without neglecting the mother.
8. The surgeon has access to the uterus and adnexa and visualization of the abdominal viscera if this is desired.
9. A transverse opening in the uterus is more easily closed than a longitudinal."

HENRY J. ROSEVEAR, M.D.

***Fifty Large Incisional Herniae Treated by* F. Langenskiold's Operation.** Langenskiold, A.: *Acta chir. Scandinav.* **106**:417, 1954.

The author reports 50 cases in which large ventral hernias were operated on between 1943 and 1953 by F. Langenskiold's method. Langenskiold described the method as follows: "The cutaneous scar is removed carefully, the hernial sac is opened with several parallel incisions, so as to create a number of strips about two centimeters wide, which are detached at one end, alternating between right and left. The peritoneum is closed, if possible, the strips are drawn through holes about two centimeters from the opposite margin of the orifice of the hernia, and tautened so that the margins can be sewn together." Then the strips may be folded back and fastened with additional sutures over the first row of sutures, or they may be tied together two and two, the ends then being sewn to the fascia.

In 29 of the 50 operations more or less extensive intra-abdominal adhesions were observed, and in 3 cases the intestine was perforated at operation. All 3 patients were cured. The number of strips made out of the scar plate varied between 2 and 9, the average being 5 or 6. Statements on separate closure of the peritoneum were not regularly made in the operative reports, but it seems that this was impossible or partly unsuccessful in more than half the cases.

There were *no postoperative deaths. Of* the 3 patients who died at a later stage, 2 died of heart disease, one of them five months and the other one *year and ten months after* the operation. One patient died of ileus three years after the operation for hernia.

Infection of the operative wound with suppuration and sinuses occurred in 24 cases. There were 7 cases of recurrent hernia following this type of repair. Of the 7 patients in whom there was recurrence, 3 had had infection of the wound after the hernia repair. Of the 37 cases in which healing was proved by follow-up examination, suppuration had occurred in 20. Some of the patients in these cases had periodically exhibited silk granulomas and sinuses for several years after the operation. In 5 years there were signs of postoperative pneumonia and in 2 a condition of subileus.

If the hernial opening is circular, the repair should comprise an elliptic area reach*ing beyond the margins of the hernial orifice* proper. If the disproportion between the visceral fat and the volume of the abdominal cavity is too large, the operation can be performed in two stages without endangering the result of the first procedure. The method can be recommended as a standard procedure for large incisional hernias.

HENRY J. ROSEVEAR, M.D.

**The Curability of Stomach Cancer.** Mason, Edward E.: J. Iowa M. 64:150, 1954.

The curability of cancer is of major importance to mankind, as cancer of the stomach remains one of the commonest causes of death, if not the chief one. It is estimated that 40,000 persons die of cancer of the stomach every year in the United States.

The greatest improvement in the past seven decades has come about through the extension of surgical aid to ever-increasing numbers of patients. There has also been a significant *improvement in the operative* mortality rate, which has been reflected in improvement of the five-year survival rate.

All past effort to attain early diagnosis and extend surgical treatment still leaves us with a five-year survival rate of 12.2 per cent as reported by the University of Minnesota Hospitals and 17 per cent as recorded at the Mayo Clinic.

The majority of patients who come to op*eration for cancer of the stomach have overt* symptoms, and very little is known, therefore, about the biologic development of gas*tric cancer early in its course. It is not* known what percentage of lymph nodes is involved or how much of the blood stream has been *invaded by gastric cancer during* the months, sometimes the year, following the appearance of the first few malignant cells.

It has been shown by others that, in resected specimens, 52 per cent of the lesions show evidence of invasion of the tumor into blood vessels. Tumor cells appearing in blood vessels do not necessarily mean metastasis to the blood stream, but the correlation may be high. Lymph node spread is present in over 60 per cent of specimens resected with intent to cure. If only a few nodes are involved, cure may be obtained.

Early diagnosis remains as a completely untried solution to the problem. The problem is twofold. First, an actual decrease in the overall lag in time between the onset of disease and the operation must be accomplished; second, unequivocal evidence as to the effect of early diagnosis on the cure rate must be obtained. The control series of early *cases should actually be a series of cases* collected by screening asymptomatic and unselected members of the general population. With such a group of surgically treated patients, one would expect 100 per cent operability and a considerable improvement over the current 40 per cent of hospitalized patients who undergo resection for cure. These persons should then be followed closely for five years, and the survival rate corrected for age and compared with the existing five-year survival rates. Such patients are being found through cancer detection center studies and *photofluorographic surveys*.

A survey of this kind has been conducted by the Minnesota Cancer Detection Center at *the University of Minnesota. Here, for each* gastric carcinoma discovered, 3 adenomas were observed. Patients with pernicious anemia have shown a 6 per cent incidence of gastric polyps, and achlorhydric patients have shown a 3 per cent incidence. Cancer of the stomach has rarely been observed when these polyps are smaller than 2 cm. in diameter. When the polyps are over 2.5 cm. in diameter, malignant change has been demonstrated in over 50 per cent of cases.

Over the age of 65, gastric cancer is present in 1 of every 500 men in the general population. It is three times as common in the male as in the [illegible] e. N [illegible] tient over the age of 30 or 40, however, male or female, should be overlooked from this point of view if vague symptoms of high abdominal discomfort are present. This was the initial symptom in over 50 per cent of patients later proved to have gastric cancer.

Cancer of the stomach may develop in a chronic gastric ulcer or may assume the appearance of one. Patients with this type of cancer, when studied as a group, seem to have a better prognosis than the larger group of unselected patients with gastric cancer. This may well be due to the fact that "ulcer cancer patients" have symptoms earlier during the growth of the cancer and reach the operating table earlier in the sequence of their disease.

Those who would treat gastric ulcers medically should review the results of a recent five-year follow-up of 414 cases by Cain. Only 20 per cent of these medically treated patients were permanently relieved of their symptoms. Thirty-four per cent finally came to operation, and over 10 per cent either had cancer of the stomach or acquired it during the five years.

For many patients with gastric cancer, months or even years may be saved in instituting treatment if physicians maintain a high index of suspicion of vague upper abdominal symptoms, and if gastric ulcer is considered primarily a surgical disease.

HENRY J. ROSEVEAR, M.D.

**Need Degenerative Changes in the Spinal Column Entail Back Pain?** Bistrom, O.: Ann. Chir. Et Gyn. Fenniae 43:29, 1954.

With the exception of a ruptured disc, no degenerative abnormality of the vertebra need be indicated by backache. In cases of osteophytosis, periosteal irritation and other roentgenologic deviations of the spine, only 20 per cent of the patients in the author's series had symptoms.

The author reports a series of 151 normal backs from the Orthopedic University Clinic in Finland, to ascertain the relative incidence of deforming spondylosis without subjective symptoms. Of the patients, 86 were men and 65 women. Most of the patients did heavy manual work.

Pathogenically, osteophytes are considered the result of damaged or prolapsed nucleus pulposus. Irritation of the annulus fibrosus accompanies osteophytosis in the majority of cases. Moreover, osteophytes are never observed in the intervertebral foramens or in the posterior aspects of the vertebra but are predominant in the anterior and lateral vertebral margins. The vulnerability of the vertebra is predicated upon inherent weakness of the anterior longitudinal interspinous ligaments.

In 107 of the 151 patients with subjectively healthy backs, osteophytes were present in the lumbar vertebrae. Forty-four patients had none. Spondylosis was common between the ages of 30 and 40 years. There were no patients over 51 years of age without osteophytes. Minimal changes were noted among women. Deforming spondylosis predominated in the male.

Disc degeneration (osteochondrosis) is a gradual exsiccation of the disc substance with a resultant rupture of the annulus fibrosus and diminution of disc material. This entity (disc degeneration) occurred in 39 of the author's series of 151 patients, 19 of whom were female and 20 male. The demonstrable age peak was between 51 and 60 years. Multiple disc involvement was manifest in the older patients. The writer asserts, however, that disc degeneration is not conditioned by age, sex or occupation.

Schmorl's nodules indicate a ruptured disc whose nuclear substance penetrates the anterior body of the vertebrae, undergoes cartilaginous transformation and hence produces a small nodular roentgenologic defect. Its discovery does not depend upon a painful lesion. This entity was noted in 28 patients, none of whom had backache.

Scheuerman's disease, according to the author, is associated with ruptured disc. This disease is a growth disturbance in the end plate of the vertebrae. The lesion occurs commonly in the thoracic part of the spine, but also in the upper lumbar vertebrae. Kyphoscoliosis may develop. There were 15 patients who did not at any time complain of painful backs.

Osteoporosis of the spine was encountered in 49 of the 151 cases studied. The disease was usually associated with spondylosis and disc degeneration, especially in the elderly patients.

S. L. GOVERNALE, M.D.

**Metastatic Carcinoma of the Thyroid Successfully Treated with Thyroxine.** Balme, B. W.: Lancet 1:812, 1954.

This is an interesting report of a case of well differentiated thyroid carcinoma with numerous functioning pulmonary deposits which proved resistant to radioactive iodine but which responded to prolonged treatment with thyroxine.

Regression of the pulmonary metastases after thyroxine treatment was indicated by clinical improvement and by definite clearing of the roentgen shadows.

Carcinoma of the thyroid that responds, like simple goiter, to thyroxine must be well differentiated and dependent to some extent on pituitary thyrotrophic hormone. That the metastases to the lung were histologically and functionally similar is indicated by the fact that the patient was euthyroid despite total thyroidectomy.

Regression of the metastases after thyroxine treatment indicates the dependence of these thyroid deposits on normal thyrotrophic stimulation from the pituitary also

THOMAS WILENSKY, M D.

**Childhood Thyroid Carcinoma in Western Europe.** Winship, T., and Chase, W., Arch. Chir. Neerland. 5:253, 1953.

Forty-two cases of thyroid carcinoma occurring in children of Western Europe are reported and compared with 188 cases collected in the United States (total 230). The combined population of Western Europe is about double that of the United States. In Europe 57 per cent and in the U. S. A. 66 per cent of the patients were female. In 5 cases of the American series the tumor was present at birth. No carcinoma in thyroid nodules is reported from Europe, while 29 per cent of the clinically nontoxic nodular goiters in American children contained carcinoma. Average duration of symptoms before treatment started was 3.4 years in Europe, 2.2 in America. Forty-three per cent of the European children had metastatic carcinoma at the time of diagnosis; no data from the United States were available. Twenty-two per cent of the European and 52 per cent of the American group had lesions diagnosed as papillary adenocarcinoma.

Methods of therapy were varied but similar in the two groups. Irradiation was equally common, but while radium was the frequent source in Europe, external irradiation and the use of radioactive iodine were the more prevalent methods in the United States. In general, operation for thyroid carcinoma is less radical in Europe than in America. No conclusion can be drawn as to results. Mortality rates are generally high. The largest number of thyroid carcinomas occurred in England, a non-goitrous area. Only 2 occurred in Switzerland, a goitrous area.

S. A. GUEUKDJIAN, M.D.

**The Late Results of Combined Surgical and Radiological Treatment of Mammary Carcinoma.** Scholte, P. J. L.; Korthof, G., and Suermondt, W. F., Arch. Chir. Neerland. 5:317, 1953.

Regional metastasis to the axillary glands —and infraclavicular, supraclavicular and mediastinal spread—is not the only secondary manifestation of mammary carcinoma. Primary lymphogenous metastases in the parasternal glands along the internal mammary artery occur in 25 per cent of all cases. On this basis some surgeons consider Halsted's radical operation not radical enough, and Adair has recommended extensive resection of the breast with the underlying muscle, as well as excision of the axillary glands, the axillary vein and the parasternal and supraclavicular glands, with resection of the clavicle, if necessary, and resection of the ribs to which the primary tumor is attached. He reports a five-year survival rate of 43.5 per cent. The authors claim that efficient radiotherapy combined with operation is more satisfactory than such extensive removals.

Follow-ups in 247 cases on three-year, five-year and ten-year survivals are reported. Fifty per cent underwent operation with after-irradiation, and 50 per cent pre-irradiation, operation and after-irradiation. The results showed no differences in the two groups; in general, however, operation with after-irradiation only is preferred.

The results obtained by operation combined with radiotherapy are better than those obtained by surgical treatment alone, and the results obtained by Halsted's operation combined with radiotherapy are identical with those obtained by extensive surgical procedures combined with radiotherapy. The authors conclude that at present the best form of treatment for carcinoma of the breast is Halsted's operation plus efficient radiotherapy; this has yielded a five-year survival rate of 45 per cent.

S. A. GUEUKDJIAN, M.D.

**Curling of the Oesopha**
P., and Keet, A. D. Jr.: S.A..

"Curling" is a noncommit
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certain cause and manifested by a variety of roentgenoscopic appearances. The reports of numerous observers have produced many colorful descriptive terms, including "rippling esophagus," "corkscrew esophagus," "multiple functional diverticula," "segmental spasms," "ladder spasms" and "rosary esophagus."

In a minority of cases the condition may give rise to dysphagia. The diagnosis is easily missed if the radiologic study is inadequate, in which case hysteria or psychoneurosis is commonly suspected.

It is usually encountered in elderly patients and not uncommonly in persons with Parkinson's disease. An imbalance of the related neuromuscular mechanisms, both local and central, has quite naturally been suspected as the cause of this disturbance.

The treatment is empiric. Mild sedatives, antispasmodics and instrumental dilations have been employed with questionable benefits. The writers of several reports have been impressed with the value of benzedrine sulfate administered orally.

THOMAS WILENSKY, M.D.

**Bicipital Tenosynovitis.** Yedinak, P. R., and Holbrook, B. G., Rocky Mountain M. J. 51:185, 1954.

The frozen shoulder syndrome or painful shoulder is a serious disability. Fracture, contusion, a fall on the outstretched hand, heavy lifting, etc., may precipitate the syndrome. Injuries to the tendon of the long head of the biceps or its bony compartment usually go unrecognized. A painful, frozen shoulder develops, with temporary or permanent limitation of motion and concomitant muscular atrophy.

The pathologic conditions are: fibrous adhesions of the sheath of the tendon to the bicipital groove of the humerus; edema; a frayed or disrupted tendon; granulation infiltrating the groove (tendinous area); bony proliferation on the floor of the intertubercular sulcus, and decalcification of the greater tuberosity and the shaft of the humerus. Other anatomic changes in the frozen shoulder are a gliding effect of the cuff muscle impeded by lymphatic and venous stasis and serofibrinous exudate, which later becomes organized and develops into a rigid fibrous adhesion, with resultant limitation of scapulohumeral motion.

The authors strongly emphasize the importance of proper diagnosis of the tenosynovitis and the recommended therapy. Prevention of permanent disability is based upon early recognition of the condition and immediate institution of medical care. They recommend a vigorous nonoperative treatment: progressive exercises, procaine injections to the "trigger point" and stellate ganglion block. Manipulation of the shoulder joint is condemned since it has often resulted in disastrous tearing of the musculotendinous cuff. In advanced stages, the authors advise surgical intervention.

The operation preferred is transplantation of the ligament of the long head of the biceps to the tip of the coracoid process and the tendon of the combined heads of the coracobrachialis and short biceps muscle.

The author reports a series of 5 cases. One patient, treated conservatively, responded exceedingly well. The other 4 failed to respond to medication, and satisfactory results were achieved only after a tendon transplantation.

S. L. GOVERNALE, M.D.

**A New Method of Exploration of the Biliary Tract (Une nouvelle méthode d'exploration des voies biliares).** Nadal, R., and Vigneau, J.: Presse Méd. 62:293, 1954.

The authors report their experiments with a new contrast medium containing 64 per cent iodine, administered intravenously for cholangiographic study. The solution used is N-adipino-di (3-amino-2, 4, 6, triiodo phenyl sodium carbonate). No untoward effects were observed after constant use of this medium for six months.

The authors consider Abreau's right dorso-oblique position most suitable for cholangiographic examination. With obese patients, and in cases of compression, the ventral position is preferred.

Experiments on a group of patients with normal biliary function (as proved by preliminary cholecytographic studies) have shown that the new opaque medium traverses the liver very rapidly, first filling the intrahepatic and extrahepatic bile ducts. Such early opacification gives valuable information on the position, distribution, form, caliber, permeability and physiologic function of the ducts. Roentgenograms are taken at fifteen-minute intervals.

The indications for intravenous cholangiographic examination are: cholecystitis, cholelithiasis, abnormalities of the gallbladder, internal biliary fistulas, primary or secondary biliary dysfunction and conditions associated with cholecystectomy or gastrectomy performed earlier. The intravenous route is contraindicated in Grave's disease, iodine hypersensitivity, liver dysfunction, acute nephritis and uremia.

Encouraging results have induced the authors to continue using this new method.

S. A. GUEUKDJIAN, M.D.

**Cesarean Section: Another Technic of Low Cervical with Extraperitoneal Drainage.** Vise, G. T.: Southern M. J. 47:293, 1954.

Dr. Vise reports a method of doing a safe cesarean section after a long, hard labor. He uses the familiar and popular low cervical approach. The uterus is not cut with a knife or scissors; a puncture wound is made, and the lower uterine segment is opened transversely with the index fingers. After delivery and closure of the uterus, one or more extraperitoneal drains should be inserted through the perivesical space down to the wound in the lower uterine segment. The bladder fold of peritoneum is carefully closed, rendering the uterine wound extraperitoneal. With the use of this easy method of cesarean section and the aid of chemotherapy and antibiotics, there may be little need for cesarean hysterectomy and extraperitoneal cesarean section for an infected or potentially infected patient.

Apparently too many cesarean sections are being performed. Fear of complications and fear of increased mortality rates makes surgeons resort to elective section in too many "borderline cases." Most women will deliver normally if allowed adequate time to do so. This method has its advantages if a section is necessary.

EDMUND LISSACK, M.D.

**"Failed Forceps": A Review of 100 Cases.** Gadd, R. L.: Brit. M. J. 1:735, 1954.

This review of 100 consecutive "failed forceps cases" admitted to St. Mary's Hospital in Manchester, England, from 1943 to 1951, reveals that the incidence fell from 3.2 per cent to 0.5 per cent of the total number of emergency patients admitted.

The commonest cause of failure was the undilated cervix. This accounted for 39 per cent. The maternal mortality rate was 2 per cent and the total fetal mortality rate 28 per cent. Pyrexia was noticed in 18 per cent of the cases.

EDMUND LISSACK, M.D.

**A New Technique of Bronchography with a Sulphanilamide Suspension of Lipiodol (Une nouvelle technique bronchographique à l'aide d'une suspension de lipiodol sulfanilamide).** Scarinci, C.: Presse Méd. 62:294, 1954.

Without the inconvenience of too rapid distribution and deposition in the alveoli, lipiodol would be the best contrast medium for bronchographic study. A new form of lipiodol with a sulfanilamide suspension overcomes these inconveniences and results in excellent bronchial impregnation without stagnation.

The technic of administration and anesthesia remains the same. Just after screening and the taking of roentgenograms the patient is asked to cough; this causes expulsion of the greater part of the contrast medium. The unexpectorated lipiodol is then completely eliminated by the body in forty-eight hours. Forced inspiration provides better pictures.

Excellent illustrations enrich this article.

S. A. GUEUKDJIAN, M.D.

**Local Ambulatory Treatment of Chronic Leg Ulcers with Hyaluronidase, Plasminogen and Antibiotics.** Spier, R. I., and Cliffton, E. E.: Surg., Gynec. & Obst. 98:667, 1954.

The authors present a rapid ambulatory method of local treatment using enzymes and antibiotics to débride, combat cellulitis, improve local circulation and promote epithelialization in chronic ulcers to augment operation and other general measures which reduce stasis.

Hyaluronidase promoted epithelializatio more rapidly. Plasminogen was valuable the preliminary débridement of ulcers [illegible] necrotic bases. Antibiotics added to [illegible] enzymes helped to combat local cellu

This procedure has been succe [illegible] many cases where the ordinary [illegible] failed.

EDMUND LISS [illegible]

FOUNDED BY DR. MAX THOREK

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## CONTENTS—NOVEMBER, 1954

Clinical and Experimental Studies in the Treatment of Coronary Artery Insufficiency by Internal Mammary Artery Implant........ 503
*Arthur Vineberg, M.D., F.A.C.S., Montreal, Canada*

Hematoma of the Rectus Abdominis Muscle: Report of a Case, Discussion of the Entity and Review of Illustrative Cases from the Literature ........ [illegible]
*Max Thorek, M.D., Chicago, Illinois, and Lauro B. DeVera, M.D., Philippine Islands*

Cardiac Rupture During Heart Massage: Ventricular Standstill Following Administration of Procaine Amide........ [illegible]
*Igor F. Nikishin, M.D., Canton, Ohio*

Clinical Anatomic Aspects of Radical Hepatic Surgery .......................... 542
*John E. Healey Jr., M.D., F.I.C.S., Philadelphia, Pennsylvania*

Cardiopericardiopexy in the Surgical Treatment of Myocardial Ischemia: The Operation and Its Results .......................... 551
*Samuel A. Thompson, M.D., F.A.C.S., F.I.C.S, and Levon A. Akopiantz, M.D., F.I.C.S., New York City, New York*

The Evolution of Anesthesiology in Brain Surgery .......................... 557
*G. Lazorthes, M.D., F.I.C.S., and L. Campan, M.D., Toulouse, France*

Hürthle Cell Tumors of the Thyroid Gland .......................... 570
*James A. Dickson, M.D., M.S. (Surg.), F.A.C.S., F.I.C.S., and William E. B. Hall, M.D., F.C.A.P., F.A.C.P., Chambersburg, Pennsylvania*

Evaluation of Urologic Problems from the Medicolegal Point of View .......................... 583
*Leonard Paul Wershub, M.D., F.A.C.S., F.I.C.S., D.U., New York City, New York*

Ovarian Pregnancy .......................... 594
*William James Moore, C.St.J., F.R.F.P.S., M.C.P.S., and John Forrest-Hamilton, K.St.J., M.D., Glasgow, Scotland*

Mesenteric Vascular Occlusion: Report of a Case with Resection, Survival and Five-Year Follow-Up .......................... 598
*Philip Ladin, M.D., F.A.C.S., F.I.C.S., New York City, New York*

Twenty-Four Hour Neomycin Preparation for Intestinal Operations .......................... 602
*Lawrence S. Mann, M.S., M.D., F.A.C.S., F.I.C.S., William Schumer, M.D., and August Tomusk, M.D., Chicago, Illinois*

Treatment of Anorectal Fistulas .......................... 607
*Stuart T. Ross, M.D., F.A.C.S., Hempstead, New York*

A Hydraulic Vein Stripper .......................... 612
*Herbert D. Trace, M.D., F.I.C.S., Chicago, Illinois*

SECTION ON OPHTHALMOLOGY AND OTORHINOLARYNGOLOGY

Indications for Eye Surgery: Physiologic Bases .......................... 614
*Arthur Alexander Knapp, M.D., F.A.C.S., F.I.C.S., New York City, New York*

EDITORIAL

A New International Service .......................... 622

NEW BOOKS .......................... 625

ABSTRACTS FROM CURRENT LITERATURE .......................... 627

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# *Original Articles*

# Clinical and Experimental Studies in the Treatment of Coronary Artery Insufficiency by Internal Mammary Artery Implant

ARTHUR VINEBERG, M.D., F.A.C.S.

MONTREAL, QUEBEC, CANADA

CLINICIANS have been aware of the disease angina pectoris for many years, and regularly have reported new medical measures that have been hailed as curative. Such treatments have swept the country in waves of enthusiastic optimism, only to be discarded in the light of cold facts. Likewise, in the past fifty years various surgical procedures, too numerous to mention, have been designed for the relief of angina pectoris. These, too, have been enthusiastically received and, depending upon the force and personality of the surgeon, have gained a certain popularity, only to be abandoned later. The surgical treatment of angina pectoris is not alone in this respect. One has only to recall the overwhelming clinical evidence presented in favour of lumbodorsal sympathectomy for the treatment of essential hypertension to be warned against the danger of a purely clinical approach to the problem of myocardial revascularization.

In my opinion, the value of any new surgical procedure must be firmly established in the laboratory before it is used in the treatment of human disease. There has been, and still is, too much

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Submitted for publication Oct. 6, 1953.

tation on the animal Homo SAP-iens!

I should like to present a method of revascularization of the ventricular myocardium which has been developed and tested in the experimental surgical laboratories of McGill University during the past eight years, namely, the internal mammary artery implant.

*Arterialization of the Intramural Vessels of the Left Ventricular Muscle by Means of Internal Mammary Artery Implantation.*—Before proceeding to the details of this method for the revascularization of the ventricular muscle, a short review of the histological, anatomical and pathological structure of the myocardium must be given. There are two factors, now generally accepted, upon which the procedure of an internal mammary artery implant is based: one is the anatomic pattern of the myocardial circulation; the other is the modern concept of the pathologic character of sclerosis of the coronary artery.

1. *Anatomic Structure of the Ventricular Myocardium:* It is well known that there are many differences between cardiac and skeletal muscles. The differences most pertinent here concern the peculiarly rich network of blood vessels that supplies the myocardial muscle fibers. Actually, there exists within the myocardium a veritable spongework of vessels. Their arrangement is graphically shown in Figure 1.[1] As the smaller branches of the coronary arteries subdivide, they leave the surface of the heart and penetrate the myocardium at right angles. As they approach the endocardial surface they resume their horizontal direction and arborize into a rich arteriolar bed, from which the capillaries arise. The arterioles also communicate directly with sinusoid arterial spaces, which connect with the myocardial sinusoids. These latter vessels, with lumens of 50 to 250 microns in diameter, run a wandering course about the muscle fibers and anastomose with each other and the capillaries. Because of the structure of the myocardium, an implanted internal mammary

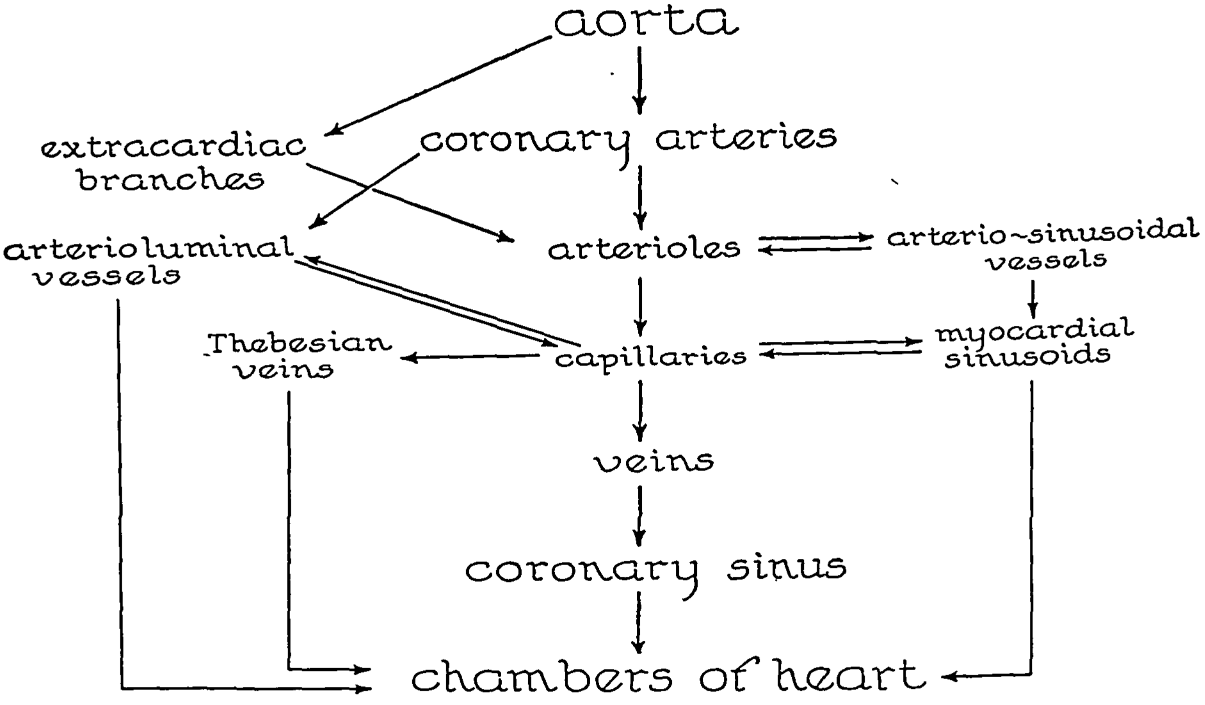

Fig. 1.—Graphic representation of relation between various components of the coronary circulation.

artery, with an open attached intercostal vessel, fails to form a surrounding hematoma and remains patent for an indefinite period.

The second factor indicating that the internal mammary artery implant will be a successful method of treating coronary artery insufficiency is based on the pathologic character and distribution of disease of the coronary artery.

2. *Pathologic Picture:* The generally accepted idea that disease of the coronary artery is widely spread throughout the coronary tree has not been borne out by pathologic study. Arteriosclerosis of the coronary arteries is usually, if not always, *confined to the epicardial part of* their courses and never involves the penetrating myocardial branches to any significant degree. Thus, in the presence of sclerosis of the coronary artery there is a vast network of arterioles, etc., deep within the myocardium, which are free of disease.[2] *If arterial blood is delivered to this* network, it can reach all parts of the ventricular myocardium. An implanted internal mammary artery thus can bridge over the blocked superficial coronary vessels, so that arterial blood can reach the intact deep arteriolar system of vessels still open and free of disease.

In the evolution of sclerosis of the human coronary artery a similar process occurs. It has been shown by Zoll[3] that in the normal human heart intercoronary anastomoses are rare. In the presence of arterial occlusion, however, intercoronary anastomoses develop distal to the point or points of occlusion. Such intercoronary anastomoses occur frequently and probably prevent myocardial infarction when the occlusion develops slowly. Zoll reported a study on a human heart with occlusion of the left anterior descending, left circumflex, and right coronary vessels of such extent that the major portion of blood supplied to the heart came from a large separate conus artery, which was connected with small branches below the points of occlusion in the descending coronary artery. It is thus not surprising that an implanted internal mammary artery, placed beyond the point of occlusion of the coronary artery and among the deep myocardial vessels, is capable of vascularizing the left ventricular muscle.

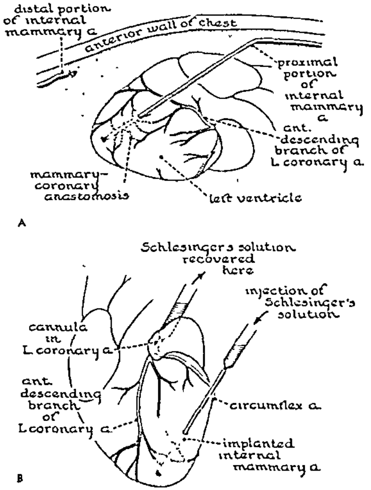
distal portion of internal mammary a
anterior wall of chest
proximal portion of internal mammary a
ant. descending branch of L coronary a.
mammary-coronary anastomosis
left ventricle
A
Schlesinger's solution recovered here
injection of Schlesinger's solution
cannula in L coronary a
ant. descending branch of L coronary a
circumflex a.
implanted internal mammary a
B

Fig. 2.—*A*, drawing of the internal mammary artery detached from its chest wall attachment and buried in a tunnel in the left ventricular myocardium. *B*, sketch showing how Schlesinger's injection mass is introduced through a cannula placed in the internal mammary artery weeks to months after implantation. In the presence of mammary-coronary anastomosis, the injection mass spreads throughout the left coronary arterial network and emerges from a second cannual placed in the mouth of the left coronary artery.

*Procedure.*—The left internal mammary artery is freed from the chest wall from the fourth to the sixth intercostal space. The distal end is doubly ligated and transected between the ligatures. A tunnel is made in the anterior wall of the left ventricle, and the freed portion of the artery is pulled into the tunnel and there fixed. *The intercostal vessels that arise from the* freed portion of the internal mammary artery are ligated, except for e sixth, which is transec e plant is pulled into the myocardial tunnel. The internal mammary artery is thus placed in a tunnel within the ventricular myocardium, with an open, freely bleeding intercostal branch (Fig. 2*A*).

In previous publications[4] it was shown that an anastomosis developed between the implanted internal mammary artery and the left coronary circulation. The presence of such a mammary-coronary anastomosis was proved in the following manner:

Weeks or months after implantation the animals were killed. Two separate cannulas were used. One was inserted into the internal mammary artery, facing toward the heart; the other was tied in the mouth of the left coronary artery. The heart and the attached internal mammary artery were removed from the thoracic cavity, and Schlesinger's injection mass was introduced through the internal mammary artery. This injection mass is known to pass freely through no vessel smaller than an arteriole 40 microns in diameter. Where there was a large anastomosis the injection mass was seen to enter the internal mammary artery, spread throughout the coronary arteries of the left ventricle, and fill the cannula placed in the mouth of the left coronary artery (Fig. 2*B*). This would indicate that the anastomosis is formed with the arterial rather than the venous side of the coronary circulation. Afterward, injection roentgenograms were taken to show the distribution of the injection mass throughout the coronary circulation.

The roentgen studies having been completed, sections were taken through the area of implantation and serial section studies were made. These serial sections showed branches leaving the implanted internal mammary artery, and these branches could be followed out into the myocardium. In Figures 3 and 4 a serial section is shown which was taken through the site of internal mammary artery implantation forty-eight days after the implantation. Note how the injection mass in the lumen of the implanted internal mammary artery can be followed out through a new branch into the myocardium.

Having proved the presence of mammary-coronary anastomosis by injection, roentgenographic studies and serial section, I decided to attempt visualization of the anastomosis by means of plastic casts.

From a few days to many months after implantation, a plastic solution was injected into the proximal end of the internal mammary artery. At the same time, similar plastic solutions of different colors were introduced into the left coronary artery and the coronary veins. The injection mass did not enter the capillary vessels. Acid and alkaline solutions were used for digestion, and the resulting casts were studied under the dissecting microscope.

Two types of implants were studied; one in which the internal mammary artery was buried within the myocardium with its end open, and the other with its end closed but with an attached open bleeding intercostal branch. When the internal mammary artery was buried with its end open and bleeding into a myocardial tunnel, an anastomosis occurred between it and the left coronary arterioles within five days. The entire left coronary arteriolar system could be filled with plastic substance through this implanted artery (Fig. 5*A*, *B*). The presence of such anastomoses has been observed at least two and one-half months after implantation (Fig. 5*C*). When the internal mammary artery is buried with its end closed, but with an open sixth intercostal artery i.e., the standard implant described frequently during the past eight years, the artery can be seen to branch at the end of twelve days (Fig. 5*D*). These branches grow and, at the end of three to four weeks, are well formed arterioles that join up with arterioles lying in the left ventricular myocardium (Fig. 5*E*). The anastomoses between the new branches from the internal mammary artery and the arterioles of the left coronary artery are, however, not usually fully developed until a period ranging from six weeks to two months has elapsed.

In some of my injected specimens the

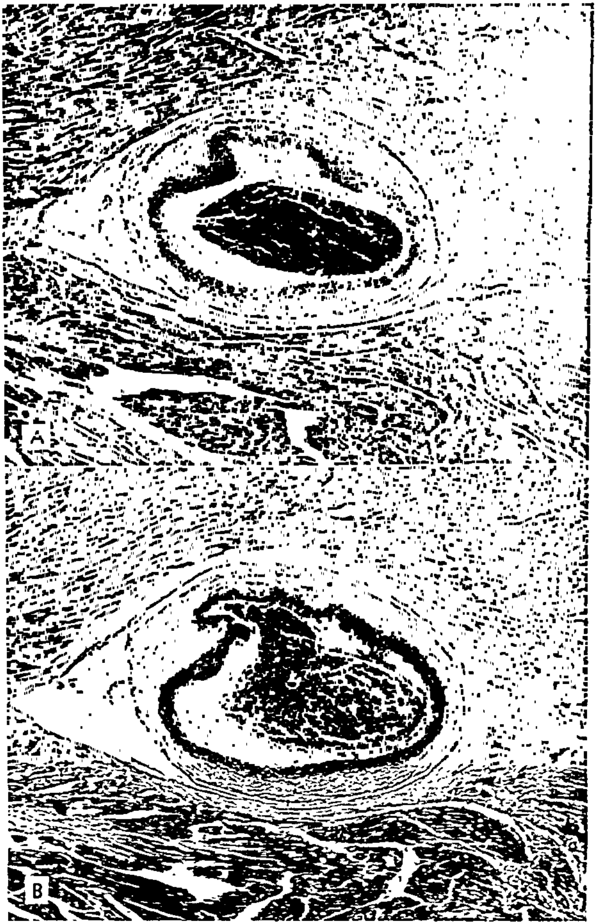

Fig. 3.—Serial section through site of internal mammary artery implant in experimental animal forty-eight days after implantation. *A*, serial section No. 13. Branching transplant with injection mass in lumen. *B*, photomicrograph of serial section No. 11 (elastic stain).

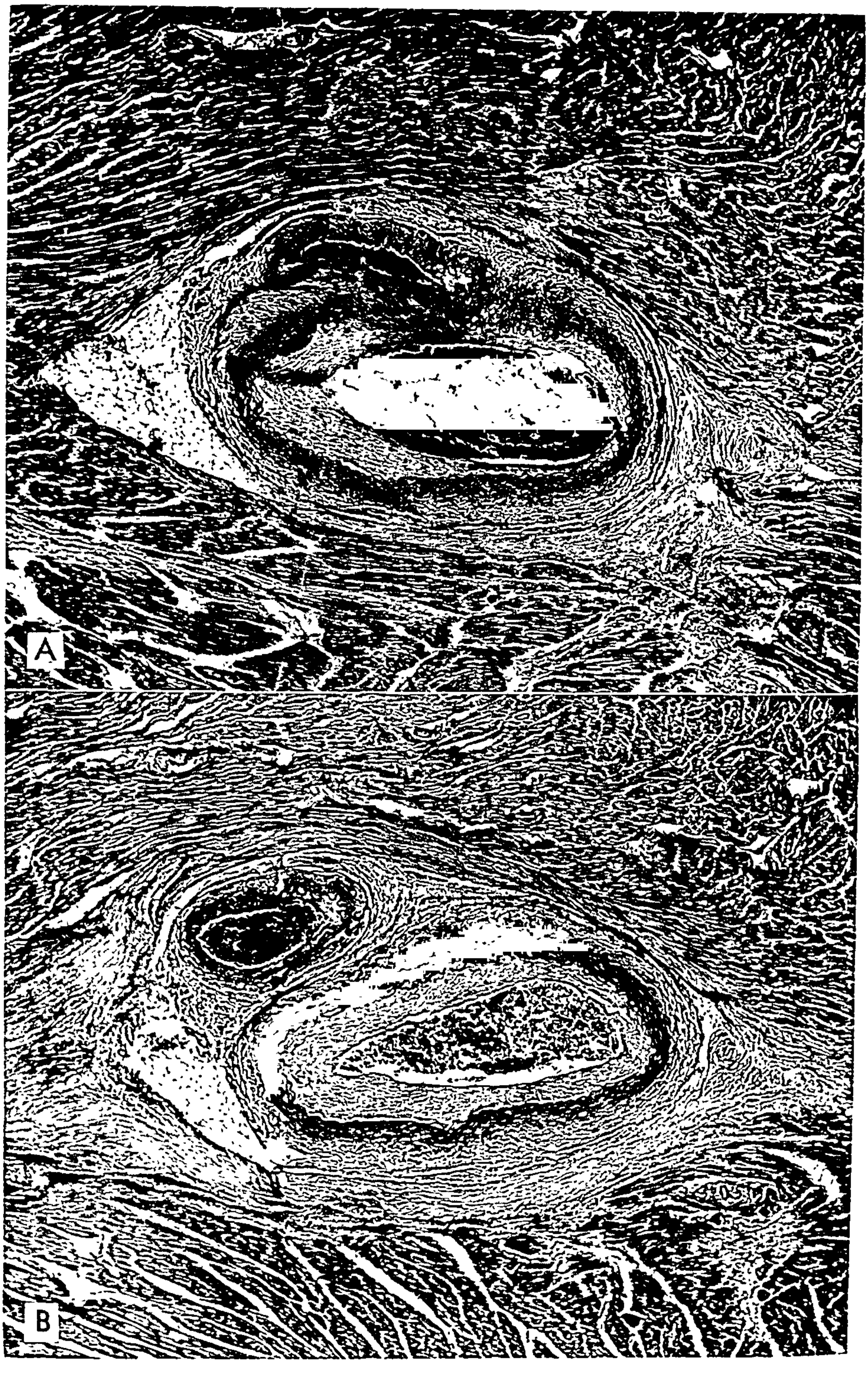

Fig. 4.—Serial section through site of internal mammary implant in same experimental animal represented in Figure 3, forty-eight days after implantation. *A*, photomicrograph of serial section No. 10; branching transplant mass in lumen. *B*, photomicrograph of serial section No. 8; branching transplant. (Elastic stain.)

casts show that the new branches join not only with the coronary arterioles but occasionally with the coronary veins (Fig. 5*C*).

*Duration of Coronary-Mammary Anastomosis.*—Glenn[5] and his associates have confirmed the development of an anastomosis between an implanted internal mammary artery and the coronary vessels. They stated, however, that the new vessels tend to disappear at the end of eight weeks. They further suggested that the new vessels were small and resembled granulation tissue.

In our series, the average interval from implant to the killing of the animal was eleven weeks (Table 1). One animal was kept for fifty-eight weeks after the implantation. The anastomoses at the end of that time not only persisted but were large enough to protect the animal against death and infarction after ligation of the anterior descending branch.

*Character of Coronary-Mammary Anastomosis.*—Not only has it been suggested that a coronary-mammary anastomosis tends to disappear at the end of eight weeks, but it has also been suggested that the nature of the anastomosis is capillary. Serial section studies of 7 implants have been examined. Special stains of these serial sections have been made to show elastic and muscle tissue. The character of the new branches formed by the internal mammary artery implant have thus been studied. They have proved to be arterial, containing both muscle and elastic tissue in their walls. These new arterial branches have been followed by serial section far out into the myocardium until they disappeared.[6]

*Value of Coronary-Mammary Anastomosis.*—Anatomohistologic proof of anastomotic channels between extracardiac arterial sources and the coronary circulation gives no indication of its functional value. This is true not only of coronary-mammary anastomosis but of all other procedures used for augmenting myocardial circulation.

Functional tests give the best indication of the value of the new arterial blood supply. These may be divided into three groups:

1. Survival experiments after ligation of the anterior descending branch of the left coronary artery.
2. Determination of the direction of blood flow in the internal mammary artery.
3. Experimental production of myocardial ischemia and its treatment by internal mammary implantation.

1. *Survival Experiments After Ligation of the Anterior Descending Branch of the Left Coronary Artery:* There is some divergence of opinion in the literature as to the effects of ligation of the anterior descending branch of the left coronary artery. There are those who claim a low mortality rate for this procedure, and others who claim a high one. The majority of investigators have found the mortality rate in dogs to range from 70 to 80 per cent. In my series of 10 control dogs the average mortality rate from ligation of the anterior descending branch was 80 per cent. It is my opinion that the great variation in mortality reported in the literature as following anterior descending branch ligation is dependent upon the site of ligation.

*Method of Ligation:* The anterior descending branch of the left coronary artery should be ligated at its point of origin. The position of the ligature must be carefully checked by examining the left coronary artery to make certain that the ligature has included all branches, other than the circumflex. Frequently one or two septal branches are missed, and occasionally branches arise from the main trunk of the left coronary artery.

An analysis of the results of ligation of the anterior descending branch is shown in Table 2. A total of 78 dogs were so treated. There were 10 controls and 39 other animals in which the coronary circulation was not augmented. In this group of animals there was an overall mortality rate of 80 per cent, with a survival rate of 20 per cent with infarction. In 29 animals, in which a large mammary coronary [illegible] devel[illegible] there were no deaths and no infarctions after anterior descending branch ligation. Thus it would seem that coronary-mammary anastomosis not only increases coronary circulation but gives protection against death and infarction.

The experimental data shown in Table 2 indicate that coronary-mammary anastomosis, when it occurs, is of value in protecting against death or infarction. However, because of the differences of opinion concerning the value of survival after ligation of the descending branch, a second group of functional experiments was performed.

2. *Direction of Blood Flow in Implanted Internal Mammary Artery.* The direction of blood flow through the implanted internal mammary artery was studied in order to determine whether it was bringing blood to the ventricular myocardium. Direct determination of the direction of blood flow in the internal mammary artery was difficult, so the indirect method was used. Animals that survived ligation of the anterior descending branch of the left coronary artery were subjected, four to five weeks later, to complete and sudden occlusion of the implanted internal mammary artery. If the internal mammary artery was maintaining the circulation of the left ventricle, then, after the ligation, either death or infarction should result. This is exactly what happened. In 3 animals with an internal mammary artery implant which had survived ligation of the anterior descending branch, the internal mammary artery was ligated. One animal died within twenty-four hours and displayed an edematous, cyanotic area of the anterior wall of the left ventricle. One survived for three days before dying from a large infarct in the same location (Fig. 6). The third survived, but examination of the specimens from animals that had been killed revealed that multiple intercoronary anastomoses were present.

In all of these animals there was a demonstrable mammary-coronary anastomosis.

There can be little doubt that in those animals which died after ligation of the internal mammary artery, the circulation of the anterior portion of the left ventricle was being maintained by the internal mammary artery implant.

The evidence just presented suggested that the internal mammary artery, after implantation into the left ventricular wall, is capable of maintaining the left ventricular circulation. These experiments, however, were carried out on the hearts of normal animals. It was therefore necessary to attempt the artificial production of insufficiency of the coronary artery and to treat it by internal mammary artery implantation.

Thus, I set out to produce and treat experimental insufficiency of the coronary artery, and so establish a third functional test of the value of an internal mammary-coronary anastomosis.

3. *Experimental Production and Treatment of Coronary Artery Insufficiency:* In this series of experiments, insufficiency of the coronary artery was produced in dogs and treated by internal mammary artery implant. The first problem was to find a method of producing coronary artery occlusion that would simulate the type of occlusion that occurs with coronary sclerosis in man.

The second problem concerned the evaluation of coronary insufficiency when it was produced, and its response to treatment.

*Method of Producing Insufficiency of the Coronary Artery:* The anterior descending branch of the left coronary artery was exposed at its origin. Beneath the left auriculoventricular sulcus to the left of the pulmonary trunk, the epicardium overlying the vessel was incised and the bifurcation of the main coronary artery exposed. A doubly folded strip of cellophane (Dupont, P.T. 300), sterilized for twenty-four hours in a saturated solution of mercury oxycyanide, was twice wrapped completely, but loosely, around the origin of the anterior descending branch of the left coronary artery and fixed in position. Thus a segment of artery from 4 to 8 mm. long was completely surrounded with cellophane.

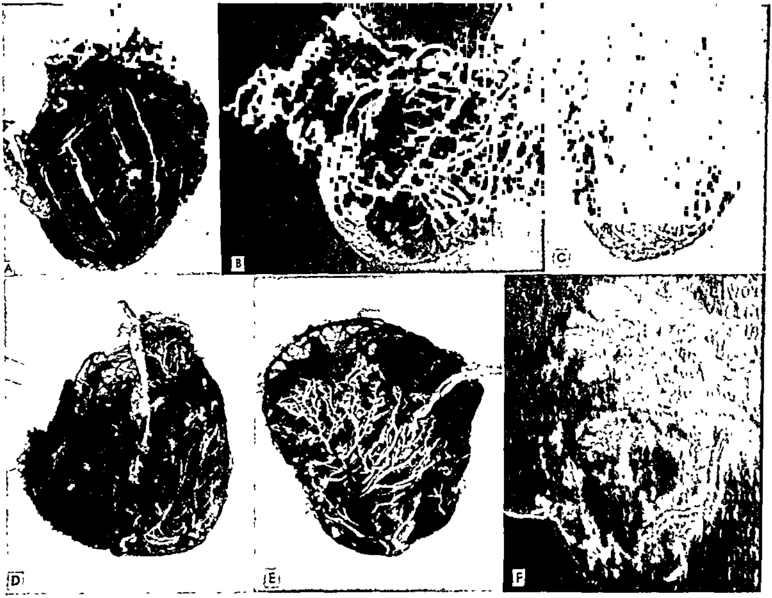

Fig. 5.—*A*, Dog 1. Internal mammary artery freed from subclavian to sixth intercostal artery and open end implanted in 2-inch (5 cm.) tunnel in left ventricular myocardium. Killed five days later in fight. Cannulas placed in internal mammary artery (shown by string) and in mouth of left coronary artery. Vinylite plastic injected and seen to fill vessels of left ventricle and emerge from left coronary artery. *B*, same cast as is *A*, except that the coronary vessels superficial to the implanted internal mammary artery were removed to show the underlying internal mammary artery. *Note* how in five days vessels leave the implanted internal mammary artery to join the left coronary arteries. *C*, Dog 2. *Internal mammary artery freed from chest wall from sixth intercostal artery to subclavian and* open distal end buried in 2-inch (5 cm.) tunnel in myocardium of left ventricle. Partial ligation of origin anterior descending done simultaneously. Seventy-seven days after operation the chest was opened and the subclavian artery isolated and injected with solution of india ink. The ink was seen to flow down the *internal mammary artery into the heart, where it was seen in the coronary vessels.* Cast was made by injecting internal mammary artery with yellow, coronary sinus with blue, and left coronary artery with red plastic solutions. *Note vast* [illegible] *also mammary venous anastomosis. D*, Dog 3. Internal m[illegible] tween fourth and sixth intercostals and placed in tunnel 1 inc[illegible] um, with open sixth intercostal. This animal died of pneumonia twelve days later. Cast made by injecting internal mammary artery with yellow, left coronary artery with red and coronary sinus with blue. Cast cut away to show buried internal mammary artery. Note tufting and branching from open sixth intercostal, attached to internal mammary artery. *E*, Dog 4. Internal mammary artery freed from fourth to sixth intercostal and implanted in 1 inch (2.5 cm.) tunnel in left ventricular wall with attached open sixth intercostal. Piece of sclerosing cellophane simultaneously wrapped around origin of anterior descending branch. Animal killed twenty-three days later because of distemper. Internal mammary artery was injected with yellow, left coronary with red, and coronary veins with blue plastic. *Note* brown color where yellow and red meet in mammary coronary anastomoses. *F*, heart of Dog. This animal withstood anterior descending branch ligation for sixty-seven days after internal mammary artery implant. Thirty-nine days later the thorax was reopened. The *implanted mammary artery* was ligated. This resulted in ectopic beats and cardiac irritability. The animal died three days after the operation. A large 3 by 3 cm. anterior wall left ventricular infarct was present. Perfusion of the internal mammary artery showed free communication between the implant and *and the left coronary arterial tree, but not between the implant and the right.*

The cellophane initiated a fibroplastic reaction, with collagen deposition about the artery. As subsequent contracture of the new fibrous tissue occurred, the lumen of the anterior descending branch of the left coronary artery was slowly narrowed. Gradually that portion of the myocardium nourished by this vessel became ischemic.

At the end of the experiment, when the animals were killed, the anterior descending branch of the left coronary artery was probed to determine the extent of the narrowing. Sections were made through the artery at the site of the cellophane wrap, and careful histologic studies were made of the degree of coronary occlusion.

*Method of Evaluation of Experimentally Produced Coronary Insufficiency and Its Treatment: Exercise tolerance test.* In the presence of human coronary arterial insufficiency there are two outstanding symptoms, namely, substernal pain and intolerance to exercise.

In the dog, it is most difficult to detect the presence of pain. It is, however, not difficult to determine accurately the animal's tolerance or intolerance to exercise.

Clinical and pathologic experience have associated progressive intolerance to exercise with progressive myocardial ischemia. Thus, in the experimental animal, progressive diminution of such tolerance has been accepted as evidence of myocardial ischemia. In this series of experiments, myocardial ischemia was produced by a cellophane wrap placed around the point of origin of the anterior descending branch of the left coronary artery. Exercise tolerance studies were carried out before and after the cellophane wrap was applied. Later, after the internal mammary artery implant, they were repeated to determine whether improvement had occurred.

A treadmill was used to exercise the animals. This was made originally for man and was thus very satisfactory for exercising large animals. The exercise tolerance of each animal was established prior to wrapping the anterior descending branch with the sclerosing type of cellophane. Two groups of animals were studied. The first group was composed of those animals in which insufficiency of the coronary artery was produced by cellophane occlusion of the anterior descending branch and treated by internal mammary artery implant. In this series the average running time was reduced from nine to twelve minutes to two and a half to four minutes, at 8½ miles per hour, three months after the cellophane wrap. These animals were given an internal mammary artery implant, and, three to five months later, the running time had returned to six to eight minutes respectively, whereas the control animals had an average running time of one and six-tenths minutes at 8½ miles per hour. In those animals with an implant in whom the running time had returned, there was a wide open coronary-mammary anastomosis.

In the second group of animals, an internal mammary artery implant was performed at the same time the cellophane was wrapped around the anterior descending branch. Where there was a widely patent mammary-coronary anastomosis there was no appreciable reduction in exercise tolerance.

*Treatment of Human Coronary Artery Insufficiency by Internal Mammary Artery Implantation.*—On the basis of the foregoing anatomic, functional and pathologic facts, the internal mammary artery implant procedure has been used in the treatment of insufficiency of the coronary artery in man.

*Selection of patients:* The selection of patients for a new procedure is always difficult. I dislike classifications, however, and in a general way I have found it convenient to divide the cases into four groups:

*Group I—Mild or intermittent angina.* In this group are those patients who have an occasional attack of anginal pain on exercise or during an emotional disturbance. They are able to work and are capable of living lives reasonably close to normal. For this type of patient operation is not advisable: it is better for him to stop playing golf!

*Group II—Progressive coronary artery*

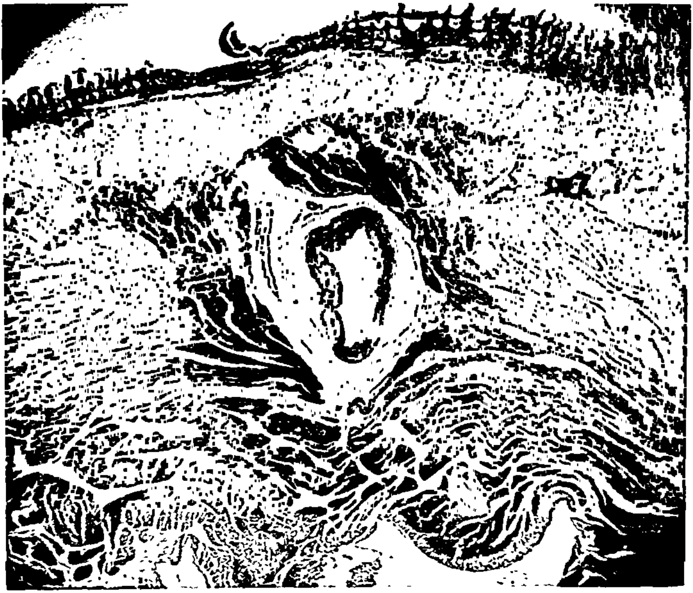

Fig. 6.—Section through human heart at site of internal mammary artery implant sixty-two hours later. *Note* how the vessel lies open between the myocardial fibers, and the absence of surrounding hematoma. This is remarkable, because the artery was pulled into position with an attached open bleeding intercostal vessel. The absence of clot in the lumen of the vessel is likewise to be noted.

*insufficiency without disability.* Evidence of progressive insufficiency of the coronary artery is an important indication for surgical intervention. Patients in this group may still be working, but there is evidence of progression of their disease. This may be shown in the electrocardiogram or by an increase in the frequency of anginal attacks and, perhaps, progressive dyspnea.

*Group III—Partial or total disability, but without angina at rest.* In this group are hundreds of thousands of persons, men and women, who are unable to walk more than 50 to 100 feet, or to do 22 steps on the Master two-step test, without anginal pain. Many suffer pain at rest, but in association with emotion, straining at stool or a heavy meal. Some have night pain, which awakens them. However, when sitting quietly in a chair, without stimuli, they are free from pain. Such patients have been accepted for operation; in fact, operation should be encouraged, as it has been shown that fewer than 50 per cent of such patients are alive at the end of five years. Another coronary artery occlusion may so lower their myocardial reserve as to place them in the hopeless, inoperable group of patients with status angina.

*Group IV—Status anginosus.* In this group are patients w ve a a whe at rest. They literally chew nitroglycerin tablets day and night. One of my patients in this group consumed 180 nitroglycerin tablets in two weeks. This type of patient should not be submitted to a cardiac surgical procedure. There is insufficient cardiac muscle left to revascularize. Generally, the patient is living on a pinpoint opening in the one artery that is still open. Such a small opening usually cannot supply sufficient blood to the myocardium to keep the patient alive during and after a major thoracic procedure. In addition, such a patient generally has very little myocardial muscle left to revascularize.

*Preoperative Investigation:* With each patient I have attempted to exclude all other possible causes of his symptoms. This has been done in spite of a well-established diagnosis of coronary artery insufficiency. A search is made for intervertebral discs and for infradiaphragmatic and supradiaphragmatic lesions, and in all cases a psychiatric screening is done. A careful examination of serial electrocardiograms for evidence of recent activity must be made, as well as repeated observations of the sedimentation rate. In a few cases I have postponed operation for four to six months on evidence of activity obtained from the electrocardiogram and the sedimentation rate.

*Contraindications:* 1. *Evidence of left ventricular failure.* The history of left ventricular failure during an attack of myocardial infarction, with recovery, is not a contraindication. The presence of left ventricular failure, however, is most definitely a contraindication.

2. *Enlargement of the left ventricle,* unless it is due to hypertrophy associated with moderate hypertension.

3. *Advanced essential hypertension.*

4. *Evidence of recent myocardial infarction or of active disease.*

5. *Status angina.*

*Present Series.*—This report deals with my experience with 12 cases of coronary

TABLE 1.—*Duration of Anastomosis*

| *Type of Anastomosis* | *No. of Animals* | *Presence of Anastomosis After Implant (weeks)* | *Value of Anastomosis After Ligation of Anterior Descending Branch of the Left Coronary Artery* |
|---|---|---|---|
| *Microscopic* | 1 | 5 | |
| | 1 | 6 | |
| | 1 | 7 | |
| Anastomosis small, owing to thickened or partially thrombosed internal mammary artery | 2 | 8 | Protection against death of infarction afforded in three animals only |
| | 2 | 11 | |
| | 2 | 12 | |
| | 2 | 13 | |
| | 1 | 14 | |
| | 12 | | |
| *Microscopic* | 1 | 6 | |
| | 2 | 7 | |
| | 5 | 9 | No deaths or infarctions |
| | 5 | 11 | |
| Anastomosis large | 4 | 12 | |
| | 2 | 14 | |
| | 1 | 17 | |
| Internal mammary artery patent | 1 | 18 | In cellophane coronary artery sclerosis caused by cellophane irritation, marked improvement in exercise tolerance occurred |
| | 3 | 19 | |
| | 1 | 21 | |
| | 1 | 31 | |
| | 1 | 41 | |
| | 1 | 46 | |
| | 1 | 58 | |
| | 29 | | |

TABLE 2.—*Experimental Data*

| | *Ligation of Anterior Descending Branch of the Left Coronary Artery* | | | |
|---|---|---|---|---|
| | *No. of Dogs* | *Death, %* | *Survival with Infarction, %* | *Survival without Infarction, %* |
| Control | 10 | 80 | 20 | 0 |
| Internal mammary artery implant and/or other experiments but without augmentation of the coronary circulation | 39 | 80 | 3 | 17 |
| Internal mammary artery implant with coronary *anastomosis* | 29 | — | — | 100 |

Note: Internal mammary artery after implantation formed anastomoses with coronary circulation in from 50 to 75% of animals operated upon.

artery insufficiency in which the patients have undergone internal mammary artery implantation in the past three years. Some of the facts concerning each patient are shown in Table 3.

The patients have been divided into two groups—those without angina at rest, and those with status angina.

All of these patients were male. Their ages varied from 36 to 57 years—the majority were over 52. All were unable to work at the time of operation. Their periods of disability varied from seven to thirty-six months.

Of these 12 patients, 10 had had one or more proved myocardial infarction. Anginal pain was not the only symptom. In 7 of these, dyspnea on effort, and in 6 fatigue, were prominent symptoms. Exercise tolerance varied from 50 to 200 feet on the level and was markedly lowered in the two-step test. Occupations varied from that of physician to that of machinist-welder. It should be noted that practically all of these patients were desperate. They had reached a stage at which life was no longer livable. The majority of them fully expected to die from the operation—and did not care. Even after the mortality rate and the chances of failure had been explained to them, they elected to undergo surgical treatment. Two of the surviving 12 patients had had anterior and posterior ventricular infarctions. This is interesting in view of Bailey's statement that multiple infarction is a contraindication to surgical treatment. It must be stated, however, that all 3 of the patients who died had had two or more infarcts. These patients, however, had pain at rest; their exercise tolerance was zero.

In the selection of patients for operation, the condition of the ventricular myocardium to be revascularized is the crux of the situation. It is futile to attempt to revascularize scar tissue. Clinical estimation of the amount of myocardial muscle remaining to revascularize is most important. In my opinion, exercise tolerance studies combined with fluoroscopic and electrocardiographic studies help to estimate the myocardial reserve.

*Results.*—The results of operation are shown in Table 4. In 12 patients the operation of internal mammary artery implant has been completed. Of these 12, 9 have survived. There have been no deaths among the patients who had no angina at rest. Even though 2 of these patients had had both anterior and posterior infarctions, there was still some myocardial muscle left to revascularize. Both have done well. In the group of 9 patients, all had been incapacitated before the operation; none were working. At the time of writing, 7 are working. Three have slight pain on severe exertion, and 1 has severe pain. Five are completely pain-free.

It should be noted that, in the case of my first surviving patient, it is now three years since the operation, and from a condition of complete disability he can now walk 10 miles through the bush.

There has been 1 failure in the group: the patient still suffers pain as severe as before the operation. Examination of the heart under the fluoroscope reveals that the apex is tilted upward and laterally, and that this is accentuated during deep respiration. It would seem that the internal mammary artery was placed in the heart without sufficient slack to allow for the movement of respiration. This artery is probably firmly thrombosed.

Perhaps the most interesting case is that of S.E., a 57-year-old electrician with a large anterior wall infarct, who was totally incapacitated. He was operated upon in March 1952 and returned to his work in September, feeling extremely well. In May 1953, severe substernal pain developed, and he was hospitalized for what appeared to be an attack of myocardial infarction but turned out to be coronary artery occlusion without infarction. This man returned to work in July 1953 and is still working. The electrocardiagram reveals no change since the operation. It would seem that he underwent coronary artery occlusion without infarction. In a heart such as his, but without the internal mammary artery implant, if death had not occurred, at least infarction should have occurred after a third coronary artery occlusion.

Of the 3 patients in status angina, 2 died sixty and sixty-two hours, respectively, after the operation, and 1 died of cardiac arrest on the operating table. In these patients the two major arteries were observed at autopsy to be blocked, and they had been living on a pinpoint opening in a remaining vessel. In each instance

TABLE 3.—*No Angina at Rest; Anginal Pain*

| *Patient Name* | *Sex* | *Age* | *Occupation* | *Time Disabled (Months)* | *At Rest* | *Amount of Exercise* | *Eating* | *Night* | *Dyspnea* | *Fatigue* | *Previous Infarction* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DM | M | 54 | Oil Field Worker | 7 | No | 150 ft. | Yes | No | Yes | Yes | None |
| ES | M | 49 | Executive | 24 | No | 100 ft. | Yes | No | Yes | No | Anterior; posterior |
| CA | M | 55 | Machinist | 24 | No | 150 ft. | Yes | No | No | No | Large anterior |
| AM | M | 55 | Grocer | 10 | No | 50 ft. | Yes | No | Yes | Yes | None |
| SE | M | 57 | Electrician | 10 | No | 50 ft. | No | No | No | No | Large anterior |
| GA | M | 52 | Farmer | 28 | No | 200 ft. | No | No | Yes | Marked | Posterior |
| LGM | M | 39 | Physician | 24 | No | 50 ft. | Yes | Yes | Yes | Marked | Anterior; posterior |
| MB | M | 36 | Railroad Switchman | 18 | No | 75 ft. | Yes | Yes | Yes | Yes | Anterior; septal |
| CH | M | 48 | Engineer | 17 | No | 50 ft. | Yes | Yes | Yes | Yes | Posterior |
| *Status Angina* | | | | | | | | | | | |
| JP | M | 53 | Tailor | 36 | Yes | 0 | Yes | Yes | No | No | Anterior; posterior |
| FC | M | 57 | Civil Servant | 36 | Yes | 100 ft. | Yes | Yes | Yes | No | Anterior; posterior |
| AC | M | 46 | Stevedore | 12 | Yes | 150 ft. | Yes | Yes | Yes | No | Anterior; posterior |

TABLE 4.—*Results*

| *Patient Name* | *Time Since Operation (Months)* | *Occupation* | *Anginal Pain* | *Exercise Tolerance* | | *Ability to Work, Hours Per Day* | |
|---|---|---|---|---|---|---|---|
| | | | | *Before* | *After* | *Before* | *After* |
| D.M. | 34 | Oil Feild Worker | None | 150 ft. | Up to 10 miles | No | 8 |
| E.S. | 34 | Executive | Yes | 100 ft. | Dances, etc. | No | No |
| C.A. | 33 | Machinist | After severe exercise only | 150 ft. | ½ mile | No | 16 |
| A.M. | 27 | Grocer | Slight, on severe exercise only | 50 ft. | ¼ to ½ mile | No | Part time |
| S.E.* | 18 | Electrician | Occasional | 50 ft. | ½ mile | No | 8 |
| G.A. | 9 | Farmer | None | 200 ft. | Not known | No | Working |
| L.G.M. | 7 | Physician | None | 50 ft. | 1 mile | No | Postgraduate course |
| M.B. | 2 | Railroad Switchman | None | 75 ft. | Not tested; improved | No | Convalescent |
| C.H. | 3 | Engineer | None | 50 ft. | 1 mile | No | Working |

*Status Angina*

3 cases, all patients died within sixty-two hours of operation.

*S.E. Internal mammary artery implant, March 1952. Returned to work September 1952. May 1953 had severe substernal pain: considered to be thrombosis without infarction. July 1953, returned to work. Has slight pain on exertion only. No change in electrocardiogram noted as following recent thrombosis.

there was very little muscle left to revascularize, and this was extremely thin. Figure 12 shows a section through the site of the internal mammary artery implant in the first of my patients who died. Note that the artery, sixty-two hours after implantation, is wide open, and that there is no surrounding hematoma.

## SUMMARY

It has been shown experimentally (1) that the internal mammary artery, after implantation into the left ventricular myocardium, *forms an anastomosis* with the left coronary circulation; (2) that the implant is capable of sustaining life and preventing infarction when a major coronary vessel, the anterior descending branch, is occluded, and (3) *that the implant is capable of revascularizing the myocardium* in a high percentage of experimental cases.

Twelve human patients have been operated upon, with 3 deaths and 8 good results.

One patient has had coronary occlusion since the operation, without infarction. This patient has returned to work, and it appears that his mammary artery implant probably protected him from death and definitely protected him from infarction.

## RÉSUMÉ

(Estudos clínicos e experimentais no tratamento da insuficiência da artéria coronária pelo implante da artéria mamária interna.)

Foi evidenciado experimentalmente (1) que a artéria *mamária interna*, após implantação no miocardio ventricular esquerdo, forma uma anastomose com a circulação coronária esquerda; (2) que o implante é capaz de sustentar a vida e *impedir* o enfarte quando um vaso coronário maior, a ramo descendente anterior, é ocluido, e (3) que o *implante é capaz* de revascularizar o miocárido numa porcentagem elevada de casos experimentais

Doze pacientes op

dos, com 3 mortes e 8 bons resultados.

Um paciente desde a operação possue oclusão coronária, sem enfarte. Este paciente voltou ao trabalho e, parece que seu implante da artéria mamária provàvelmente o protegeu da morte e definidamente do enfarte.

## ZUSAMMENFASSUNG

Es ist experimentell nachgewiesen worden dass (1) die A. mammaria int. nach Einpflanzung in das Myokard der linken Herzkammer eine Anastomose mit der linken Kranzader bildet, (2) das Transplantat imstande ist, das Leben zu erhalten und einer Infarktbildung vorzubeugen, wenn eine grössere Kranzschlagader, nämlich der vordere absteigende Ast, verstopft ist und (3) ds Transplantat in einem hohen Prozentsatz der Versuchsfälle den Herzmuskel revaskularisieren kann.

Von zwölf operierten Kranken starben drei, während acht gute Resultate aufzuweisen hatten.

Einer der Patienten erlitt seit der Operation einen Kranzaderverschluss ohne Infarktbildung. Inzwischen ist der Kranke wieder zu seiner Arbeit zurückgekehert; offenbar hat die Einpflanzung der A. mammaria int. ihn vor dem Tode gerettet und sicherlich die Bildung eines Infarktes verhütet.

## RESUMEN

Se ha demostrado experimentalmente: (1) que después de la inplantación de la arteria mamaria interna en el miocardio ventricular izquierdo se forma una anstomosis con la circulación coronaria izquierda; (2) que la inplantación es capaz de mantener la vida y prevenir el infarto cuando se ocluye un vaso coronario grande ó una rama descendente anteior, y (3) que la implantación es capaz de revascularizar el miocardio en alto porcentaje de casos experimentales.

Se han operado doce pacientes humanos con buenos resultados en 8 de ellos, y muertes en los 3 restantes.

Un paciente tuvo una oclusión coronaria después de la operación, sin presentarse infarto. Este paciente volvió al trabajo y parece ser que la inplantación de la mamaria interna lo protegió de la muerte y definitivamente del infarto.

## RIASSUNTO

E' stato dimostrato sperimentalmente 1) che l'arteria mammaria interna impiantata nel ventricolo sinistro forma anastomosi col circolo coronarico di sinistra; 2) che tale impianto può mattenere in vita e prevenire l'infarto dopo legature della descendens antenior; 3) che può rivascolarizzare il miocardio in un gran numero di casi sperimentali. Sono stati operati 12 pazienti, con 3 morti e 8 risultati buoni. Uno di esse aveva un'occlusione coronarica senza infarto; riprese il lavoro dopo l'intervento, sicchè si può considerarlo guarito.

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# Hematoma of the Rectus Abdominis Muscle

## Report of a Case, Discussion of the Entity and Review of Illustrative Cases from the Literature

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A CASE of spontaneous hematoma in the rectus abdominis muscle or within its sheath invariably arouses a great deal of clinical interest, owing to the rarity of the condition and the diagnostic puzzles it often presents. Doubtless more cases occur than are recognized and reported, and those in which the diagnosis has been confirmed supply a considerable literature on the subject. In 1949, Aird stated that some 150 cases had been recorded, and a number have been published since then.

Many hematomas of the rectus abdominis are associated with definite etiologic factors; for example, those occurring during pregnancy or during epidemics of diphtheria. There remain, however, cases in which no obvious cause can be discovered. In these the individual cause must be based on speculation drawn from knowledge of comparable cases and a basic understanding of the mechanical character of the muscle as well as its vascularization.

Statistics on extensive series indicate that cases of this "idiopathic" type make up a major group—not improbably the largest. This is especially important from a diagnostic point of view, for a hematoma of the rectus abdominis may readily simulate any of a number of intra-abdominal lesions, thus leading to misdiagnosis. Indeed, an examination of the literature shows all too clearly that this is the rule, the correct diagnosis being confirmed in most instances only after intervention and examination of the abdomen. Only in a minority of cases has the preoperative diagnosis proved correct.

It is therefore essential, first, to become aware of the possibility of this condition in a given clinical picture, and second, to learn to recognize the minimal points in a case history that might direct attention to this possible diagnosis. With this object in view, the following personal case history is submitted.

### REPORT OF CASE

The patient, a white woman aged 35, was admitted to the hospital on Nov. 29, 1952, with complaints of severe pain in the right lower abdominal quadrant, with tenderness and nausea. Apparently the illness had begun one week before admission as an intermittent smarting sensation in the right lower quadrant especially while the patient was at work. On the third day (the fifth before admission) the paroxysms became progressively heavier and longer, lasting for several seconds. Throughout the day prior to admission the pain grew sharper, coming at shorter intervals (about thirty minutes) [illegible] ...t minute. It came on [illegible]

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ing of chilliness over the whole body. Urination was more frequent than usual, but the *patient could urinate at the height of pain.* On the morning of admission, while on the way to work, she felt a sudden, sharp, continuous, stabbing pain—not colicky and not throbbing—localized primarily in the right lower quadrant of the abdomen, with mild radiation to the right lumbar area. This excruciating pain was accompanied by cold sweats, as urge to urinate (without successful urination) and a fainting sensation. After an hour the patient could neither bend the abdomen nor flex the right thigh without aggravating the pain, and the area had become so tender that minor pressure evoked a loud cry. By about noon the patient sought the advice of her physician, who brought her at once to the hospital.

She was extremely nervous and complained of extreme pain, nausea, and constipation (no bowel movement had occurred since the start of the sharper paroxysmal pain on the day before admission). Urination was free. The pulse rate was 88, respiratory rate 20, the temperature 99 F. and the blood pressure in millimeters of mercury 150 systolic and 100 diastolic. The patient seemed more comfortable with the legs outstretched than in the crouching position.

Physical examination showed her to be fairly well developed, with no abnormalities of the head, neck, chest, lungs or heart. The abdomen showed no visible bulges or peristaltic waves. Its color was normal, even in the area of pain. Palpation revealed such marked tenderness in the right lower quadrant that rebound tenderness could not be elicited because of discomfort to the patient. In the same area a somewhat elongated, vertical and definitely bordered mass 3 by 5 inches (7.5 by 12.5 cm.) was palpable, but no throbbing or thrill was detected. Percussion produced normal resonance and no tympanism; on the tender area percussion was not tolerated. Auscultation revealed no borborygmi or any abnormal sounds such as increased peristaltic sounds indicating bowel obstruction. The skin in general was of normal color, without petechiae or ecchymosis on any part, including the area of abdominal tenderness. The reflexes were normal. Vaginal examination showed no leukorrhea or bloody discharge. The uterus was apparently anteverted. It was movable and not enlarged. The cervix was hard and closed; pushing it upward caused pain referable to the right adnexae. The right adnexae seemed full; the left adnexae, free and nontender. Abdominal and vaginal fingers could not be approximated without causing much pain and discomfort. A blood count on the day of admission showed 4,000,000 erythrocytes and 8,600 leukocytes per cubic millimeter, with 26 per cent lymphocytes and 1 per cent monocytes. The Kahn test gave a negative result. The urine was normal in all respects.

*Previous History.*—The menstrual history was normal. The social history and habits, were irrelevant. There was no history of venereal disease. The patient had undergone cholecystectomy seven years earlier for cholecystitis and cholelithiasis; nine years earlier, appendectomy for acute appendicitis. She reported that *after a tooth extraction a year prior to admission bleeding was hardly controllable for five hours, requiring epinephrine, coagulants and gauze packing.* She also stated that, since childhood, *finger cuts had given rise to abnormally prolonged bleeding; that about a month prior to admission a small scratch on the dorsum of the right wrist bled for fifteen minutes or longer.* No spontaneous bleeding of the oral or rectal mucous membranes, however, was noticed except when she brushed her teeth. She said that in her work in a dress shop she occasionally bumped her hip and the right iliac region against the edge of a table, causing a mild contusion with hematoma lingering a couple of days. Such contusion or hematoma, she claimed, had not occurred for the past two months. There was no history of spontaneous petechiae, ecchymosis or other closed hemorrhages.

*Roentgen Examination.*—A scout film of the abdomen revealed an area of diffuse density occupying the small pelvis and the lower part of the abdomen, with no evidence of a distinct tumor mass, intestinal obstruction or urinary or biliary concretion. The roentgen observations suggested a soft tissue structure of undetermined origin occupying the small pelvis, possibly a tumor of the genital organs.

*Course.*—During the first five days the patient was under conservative treatment and observation. On admission she was directed to take nothing by mouth and was given intravenous dextrose with thiamine hydrochloride. Duracillin and Demerol-H were also administered, and an ice cap was applied to the lower part of the abdomen. On the next day she felt much better, but the tenderness was not controlled. Intravenous fluids were discontinued and she was given a liquid diet, with sulfathalidine given by mouth every four hours. At the end of the fifth day, comparatively speaking, she was much improved, with the pain considerably diminished. The mass, however, was still palpable, undiminished in size and extremely tender.

The clinical diagnosis at this time was *right twisted ovarian cyst.*

*Operation.*—Operation was undertaken on the following day (the sixth). A median suprapubic incision was made, and the peritoneum was observed to be normal in color and consistency. The right rectus muscle, however, was swollen, pushing the subcutaneous tissue and skin upward from about 1½ inches (3.7 cm.) below the level of the navel to an area just above the pubic bone. The muscle was decidedly bluish and evidently hematomatous. It was opened, without involving the peritoneum, and an extensive hematoma was discovered in the muscle, extending down to the pyramidalis portion. The clotted blood was evacuated and the oozing cavity packed with gauze.

Immediately after the operation the patient was given routine postoperative care, with penicillin, Demerol and surgical liquids. A blood test four hours after the operation showed a coagulation time of three minutes, a bleeding time of four minutes and thirty seconds, and a platelet count of 468,000. Six days later the coagulation time was five minutes and thirty seconds and the bleeding time four minutes and thirty seconds. The gauze packing was pulled out fractionally during two days after the operation. On the first postoperative day the patient was practically free from pain, except the usual pain after surgical treatment, and was comfortable until her discharge, ten days after the operation. The postoperative course was uneventful.

## COMMENT

*Anatomic Background.*—A discussion of this and similar cases may well begin with certain anatomic considerations. The anatomic picture has been described in an outstanding study by Brödel, which is the chief source of the following observations.

The rectus abdominis as a whole undergoes great extension and contraction, especially in extension and flexion of the trunk, and its morphologic character seem to facilitate this action. The muscle is divided into four or five separate masses by transverse tendinous intersections, an arrangement that permits maximum contraction with minimum bellying. Provision is thus made for the great exertion required in raising the body from the horizontal and for the strains of coughing and defecation. In addition, the muscle is under almost constant tension in regulating the intra-abdominal pressure and in expiration (Fig. 1).

Incidentally, in the dynamics of the muscle, the superior pubic ramus and the symphysis pubis are really the fixed points and should be considered the origin, though the symphysic end is traditionally described as the point of insertion. This point has a bearing on rupture and possible hematoma formation, for both conditions occur most frequently in the lowest muscle segment adjacent to the pubis, which is the narrowest and thickest part of the muscle (Fig. 2*A*).

The vascularization of the rectus muscle also appears to make provision for vigorous contraction and stretching. The vascular system is really twofold. The inferior epigastric artery rises from the external iliac artery and flows cephalad, while the superior epigastric artery rises from the internal mammary artery and flows caudad. The main vessels of these systems lie in a shallow groove on the dorsal surface of the rectus, entering the muscle at the midepigastric portion, where the systems join. The branches from the main vessels likewise lie on the dorsal surface for some distance, especially on the lower rectus, before entering the muscle. Thus they are spared undue stretching and torsion from the stretching and bellying involved in muscular activity. Provision for vascular freedom is especially important in the venous system, since the two veins accompanying each artery and arteriole are more fragile and thinwalled (Fig. 2*B*).

Muscular contraction is important to proper blood circulation; stasis and agglutination do occur, however, having been observed even in normal circulation, and may lead to minute thrombosis and hyaline degeneration of muscle fibers. Brödel suggested that the hyaline degeneration of muscle may follow stasis, agglutination, and minute thrombosis, especially in the venules. This may occur in the presence of mild infection or even in a state of health. If the degeneration is considerable, the unaffected part of the muscle may tear the weakened portion and its veins or, less easily, its arteries.

Another important anatomic feature is the tendinous rectus sheath encasing the muscle. The anterior leaf of the sheath covers the entire ventral aspect, adhering to the transverse tendinous inscriptions. Dorsally, however, the posterior leaf is not adherent to the muscle and ends with the linea semicircularis Douglasi, leaving the lower rectus muscle exposed, as well as those vessels of the inferior epigastric system which lie free on its ventral surface. In this area the muscle is separated from the viscera only by the thin peritoneum and is readily exposed to infection. A hematoma between the muscle and its posterior leaf, spreading downward to this exposed area, would thus press upon the peritoneum, causing symptoms of intra-abdominal disease (Fig. 3).

Teske, in reviewing the location of hematomas in 100 cases collected from the literature, has pointed out the further importance of the anatomic features. A hematoma in the lower third of the muscle not only can dissect laterally but can spread to the opposite side, as the recti are not here separated by dense fibrous tissue. A hematoma at a higher level could be expected to spread upward or downward, though it could extend below the linea semicircularis. Hematomas have been recorded as extending the entire length of a muscle, either right or left (Hobbs; Zohman). The right lower rectus seems to be the site in about half the cases (Teske; Wohlgemuth), with the left lower coming next in order, then the right upper and the left upper. Of 4 cases of bilateral hematoma reviewed by Teske, 3 may have involved crossing of the midline.

*Etiologic Factors.*—Of course, the muscular strength and the possible degeneration of muscle fibers vary widely among individual persons, so that one finds a wide variety of traumas sufficient to precipitate rupture of the muscle or its vessels. Sometimes this takes the form of a definite external trauma or a definitely recognizable strain. At other times the course of infectious disease has clearly laid the goundwork of muscular degeneration, so that minimal trauma is sufficient. Obesity, pregnancy, or childbearing may impose excess strain, so that a small trauma—frequently due to a severe coughing spell or to strain at defecation—will precipitate rupture and hemorrhage. In other cases no trauma is recognizable, and the hematoma is readily mistaken for an acute abdominal condition.

All these conditions have been reported in the literature. Perhaps the earliest case of rectus abdominis hematoma recorded in full was that reported by Richardson in 1857. An athletic young man aged 28, after hopping over a narrow ditch, immediately noticed an acute persistent pain about 2 inches (5 cm.) below and to the right of the umbilicus, followed by nausea and a constant desire to evacuate the bowels. It was said that he heard the sound of the muscle snapping immediately before he felt the pain. Two days later his condition had become worse, with sleeplessness, vomiting, nausea, headache and tenesmus. Operation revealed a large clot, weighing about ½ pound (226.8 Gm.), resting on the peritoneum and pressing on it and the viscera. The entire right

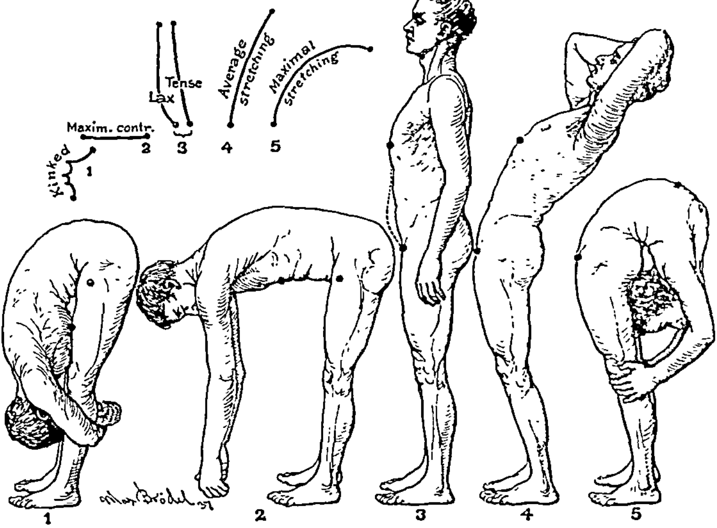

Fig. 1.—Rectus muscle in five positions of the body: *1*, maximally contracted and kinked (acrobat); *2*, maximally contracted and straight; *3*, erect, lax and tense; *4*, average stretching; *5*, maximally stretched (acrobat). *Reproduced by permission of the Johns Hopkins Press from Brodel, op. cit.*

rectus abdominis muscle and its sheath, vessels and nerves, together with the epigastric artery, had been torn across between the lineae transversae. The clot was cleared and one artery subjected to torsion. Recovery was satisfactory.

Richardson also referred to an earlier case that he had seen mentioned but not reported in detail. Earlier cases were also collected by Maydl (1882), who published a list of 14 occurring between 1809 and 1881.

Many of the traumatic hematomas have been observed in young men in the course of exercise or military training. These include both internal trauma, such as quick or excess strain, and external trauma, such a blows or bumps. World War II added a number in which this lesion occurred in military trainees; for those in the United States Services, see the series of Bowers and Richard and that of Fruin and McLaughlin.

Pregnancy is an important etiologic factor, according to Culbertson, who stated that most female patients are either pregnant or parous. In practically all cases in which the hematoma occurred during pregnancy the patients were said to be in the second half of the period of gestation.

The earliest report of spontaneous hematoma of the rectus in pregnancy is thought to be Stoeckel's 2 cases (1901). Each of the lesions was apparently precipitated by a coughing s[illegible] th[illegible]nd, that the midwife di[illegible] patient was delivered of her child by normal labor fourteen days before entering the clinic to be treated for the remaining swelling. Operation revealed a hematoma in the right rectus sheath, with partial rupture of the muscle bundles. Vogt (1913) reported a case in which bilateral tumors were discovered after successful childbirth, apparently having developed during labor. Rest and application of icebags reduced the pain and somewhat diminished the swelling. The patient was discharged after twenty-one days, and four weeks later evidence of the condition had disappeared, without operation.

A third important type of hematoma is that associated with debilitating diseases. A study of this type suggests that some similar process may be at work in those cases in which a clear-cut disease entity is not evident. The remarks by Vilar on this situation deserve quotation:

"The cause of these spontaneous hematomas resides in a vascular and muscular alteration produced by general diseases, and the minimal trauma is simply the precipitating factor. They occur very frequently in the course of typhoid, generally in the course of the third week, in grippe, chickenpox, scarlatina, measles, gonorrhea, tuberculosis, etc., that is to say in all affections which increase the muscular-vascular friability. In fact, histological studies of the muscular fibers in the zone of the hematoma show waxy degeneration and fairly characteristic color alterations. Similar pictures are described in arterial diseases (like advanced arteriosclerosis), blood dyscrasias (as for example hemophilia or purpura thrombocitopenia), in leukemia and cirrhosis."

In addition, Cullen has mentioned the importance of influenza and influenzal pneumonia as predisposing diseases.

The pathologic manifestations of this type of degeneration have received considerable attention. Virchow (1857) described the appearance of the tumor in ruptured rectus muscles in cases of typhoid fever. Zenker (1863) described the condition as observed in autopsies on patients who had died of typhoid during an epidemic of that year, and the name "Zenker's degeneration" has been given to this type of hyaline degeneration of the muscle fibers. The degeneration is also associated with influenza, and the epidemic of 1918 brought on numerous cases, many in army camps, where it was evidently an etiologic factor in producing hematoma. The condition in American Army camps has been covered in a number of reports, including those of MacCallum, Beals and Wolbach.

These studies provide some background for an understanding of the cases of elderly patients, in which the cause is so often mysterious or undiscovered. It is notable that most of the hematomas labeled "spontaneous; cause unknown" have been reported as occurring in the aged, even though the largest single group of patients seems to comprise active young men with tumors clearly due to trauma or disease as aforedescribed. When one considers the weakness and distention due to age and obesity, remembers the role of heart disease and atheromatous vessels, and allows for the possible presence of hyaline degeneration that may not be clinically identifiable, one begins to understand how a strain from coughing or defecation can lead to rupture and hemorrhage.

Such a case has recently been described by Kinder. The patient was an elderly woman, obese and dyspneic, in whom griping pain in the upper part of the abdomen, with vomiting, was first diagnosed as obstruction of the large bowel. Operation revealed a large hematoma in the left rectus muscle (Fig. 4). Six days later the patient died of pulmonary embolism. Autopsy revealed a second hematoma on the opposite side. Kinder expressed the opinion that this was the first case of the bilateral condition to be reported. It should be recalled, however, that the hematoma in Vogt's case was apparently bilateral, though of course the diagnosis was not directly verified by operation or autopsy. Wohlgemuth also reported 4 bilateral hematomas.

Collection and review of large numbers of cases have led to attempts at classification, or at least some sort of convenient grouping of the entity, whether on pathologic or clinical grounds. Among the more inclusive reviews may be mentioned those of Wohlgemuth (127 cases), [illegible] (41), Rose (32), and Teske ([illegible]). Teske's breakdown, with the number of cases in each group, is as follows: traumatic, 13; pregnancy, 22; disease, 5; idiopathic, 53 (patients mostly elderly). [illegible] used an overall classification of (1) spontaneous hematoma and (2) traumatic hematoma and suggested instead that the [illegible] be the classification changed as (1) direct and (2) indirect, the second type being that for which a pathologic process has laid the groundwork for the immediate precipitating cause. [illegible] noted that

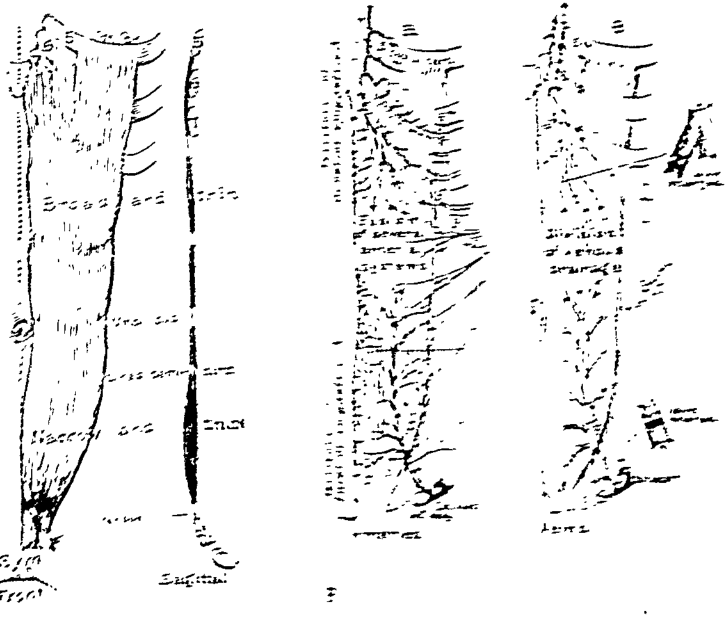

FIG. 2. A, [illegible]

in most of the cases in the literature the symptoms are divided between "acute" and "delayed," the slow or delayed growth of the hematoma indicating that some strain or weakening preceded the precipitating cause. This grouping is suggestive from the point of view of therapy—that is, when the diagnosis is certain and a choice is possible.

*Signs and Symptoms.*—The clinical picture presented by this type of hematoma, as revealed in the literature, shows considerable variety, which is not surprising when one considers the pathogenesis in the individual cases reported. It is possible, however, to enumerate the signs and symptoms that must be kept in mind.

*Pain in the abdominal region* is the most common early symptom. This may be mild or severe, generalized or localized. We shall refer to 1 case, however, in which there was complete absence of pain in the early stage. This type is easily accounted for when one recalls that the pain is associated with pressure of the clot, or fluid, within the muscle or its sheath, or between the muscle and the peritoneum, and that, when the hemorrhage is gradual, the early warning may be merely a vague feeling of discomfort. In severe involvement, with large tumors and much distention, there may be exquisite tenderness and hyperesthesia of the area. Many patients have presented an appearance of severe distress and acute illness.

*Muscle rigidity* is to be expected. Of Teske's series of patients, half showed rigidity of a quadrant or of the whole rectus on the affected side. In a few there was general rigidity of the abdomen. This condition frequently poses an important diagnostic problem, since it interferes with observation or palpation of the tumor mass. On the other hand, a case is recorded (Morgan) in which a hematoma in a 20-year-old man, precipitated by a dive in which the patient struck flat on the abdomen, caused such extreme tenderness that the area could hardly be touched, yet there was no rigidity or spasticity.

*A mass* is usually palpable, though it may not always be visible, especially in the obese patient. Sometimes it is definite, *resembling a hernia;* in Stoeckel's case, as has been mentioned, it was mistaken for the head of a fetus. It is important to try to localize this mass, though this is not always easy or possible. If it is palpable, one can test for *Bouchacourt's sign* by having the patient contract the recti. This is easily done by having him sit up from the supine position. The maneuver has been described in Vilar's excellent paper:

> "In the first place by means of careful palpation we have found a small tumor; we must then establish whether its situation is parietal or internal. For this we have the patient contract the abdominal wall; if the tumor is subcutaneous, it becomes manifest, retaining and making more manifest its mobility with respect to the underlying muscular plane; if it is situated between the muscular layers, its characteristics do not change, but take on a peculiar firmness; finally those situated in the preperitoneal or intraperitoneal space disappear completely. But this useful maneuver loses its value in cases of flaccid abdominal walls such as those of multiparas, patients who are very obese, who have had ascites, etc."

Of course the maneuver is also hard to apply when the mass cannot be adequately palpated, owing to tenderness.

Another sign is *ecchymosis and discoloration* of the skin. It is reported that this is rare; if it is reported or elicited in the case history, however, it suggests muscular or vascular fragility. When it is observed in a patient at the time he presents himself, it is usually located not over the mass but just above the pubis, in the perineum, in the scrotum or in the labia majora. More often it appears as a semicircle below the umbilicus, since at that spot the blood passes more easily around the medial border of the rectus (Aird). Furthermore, when it appears in the clinical picture it is usually a *rather late sign.* In Teske's series it appeared on the average four days after the onset of symptoms, though in a few cases it was visible when the patient first presented himself.

The *temperature range* is important. Usually it is normal or only slightly subnormal. On the second or third day after onset there may appear slight elevation, sometimes in association with leukocytosis.

*Leukocytosis* appears to be the rule. According to Teske, it was nearly always observed when the blood count was reported. The average leukocyte count was 11,600 per cubic millimeter; the highest in his series, 18,600 (78 per cent polymorphonuclears). In the same cases, platelets, bleeding time and coagulation time were within the normal range. The systolic blood pressure showed an average of 154 mm. of mercury and a maximum of 232 mm.; the diastolic pressure averaged 88 mm., with a maximum of 132 mm.

*Nausea and vomiting* are reported frequently. Vomiting with prostration is associated with rapid development of the hematoma.

*Massive loss of blood* may bring signs of *shock, depending on the amount lost.* In many cases the pulse is weak and rapid, and there are pallor and cold perspiration. Apparently Hobbs' patient died from shock and loss of blood.

In other cases, when the sheath has ruptured, staining of abdominal fat may not be seen until the skin is cut, but is then one of the first hints of the true diagnosis. In obscure conditions, however, the extravasation may not be evident until the sheath itself is incised (Cullen).

*Differential Diagnosis.*—Diagnosis is difficult in those cases in which there are signs of intra-abdominal disease and in which the history gives little hint of rupture or trauma. On the other hand, the diagnosis may not be difficult when the history causes a suspicion of muscular rupture.

*Diagnoses Made in Cases of Hematoma of the Rectus Abdominis Muscle**

| | Cases |
|---|---|
| Hematoma of the rectus muscle (correctly diagnosed) | 17 |
| Ovarian cyst | 22 |
| Appendicitis | 12 |
| Ventral hernia | 5 |
| Intestinal obstruction | 3 |
| Gallbladder disease | 2 |
| Malignant tumor of the abdomen | 2 |
| Ectopic pregnancy | 1 |
| Tetanus | 1 |
| Desmoid tumor | 1 |
| Hydronephrosis | 1 |
| Twin pregnancy | 1 |
| Miscellaneous conditions | 12 |
| Diagnosis not given | 20 |
| Total | 100 |

*From Teske, *op. cit.*, by permission of the American Journal of Surgery, Inc.

*In only 3 of Culbertson's collection of 41 cases was the correct diagnosis made preoperatively. In Teske's series of 100 cases there were 17 correct preoperative diagnoses;* in most of the other cases the condition was mistaken for intra-abdominal disease, and in a few for lesions of the abdominal wall. The distribution of the diagnoses in Teske's series is shown in the accompanying table. Santo Tomas has also presented an interesting table of diagnoses in each of 27 cases, including 4 of his own. Of these, 4 are correct (2 his own).

Of course, the *position of the hematoma* has much to do with the condition it simulates and with the diagnosis. In the greater number of cases it has occurred in the right lower abdominal quadrant, and this has accounted for diagnoses of *acute appendicitis, ovarian cyst with twisted pedicle, ovarian abscess* and *ruptured tubal pregnancy.* A hematoma in th[illegible]ation may also [illegible] *ginal* On the [illegible] mistaken for *hernia* or *thickening of the sigmoid.* In Kinder's case, already cited, the condition was diagnosed as an intestinal obstruction, though it occurred on the left. Hematomas above the umbilicus have led to diagnoses of *hydronephrosis or acute disease of the gallbladder.*

*Coexisting disease* or sequelae may also complicate the picture. This is one reason why the condition in pregnancy can be difficult to diagnose. Cases have been reported that offered even greater diagnostic puzzles. In Hughes' patient, aged 39 and pregnant, a kidney stone was demonstrated on the same side as the hematoma. Morgan's patient, a man aged 29, also had chronic inflammation of the appendix. In the case of Fothergill's patient, a woman aged 57, pelvic examination pointed to the probability of an ovarian cyst, while Bouchacourt's sign suggested trauma of the abdominal wall. Operation verified the presence of the coexisting conditions.

A detailed consideration of the differential diagnosis in the case here reported may throw some light on the situation so often faced.

The differential diagnosis was as follows: 1. *Acute appendiceal abscess,* suggested by the pain and palpable mass in the right lower quadrant, together with nausea and constipation. This was ruled out because of the previous appendectomy, normal leukocyte and differential counts, an afebrile temperature, and the palpable non-throbbing mass. 2. *Possible rupture of a right ovarian follicle.* This hypothesis was based on the pain in the right iliac region immediately after menstruation or concomitant with it, together with the absence of fever and leukocytosis. This was ruled out because the abdominal pain was unusually severe for rupture of an ovarian follicle, the definitely palpable mass indicated something more than a ruptured follicle, and the blood count showed no signs of anemia from intra-abdominal bleeding. 3. *An ectopic pregnancy* was thought possible because of the abdominal mass, together with sudden severe pain in the right lower quadrant, with nausea and fainting. This was ruled out for lack of any symptoms of pregnancy, such as amenorrhea, or any evidence of pregnancy in the breast or on vaginal examination; also there was no anemia or positive blood chemical evidence of hemorrhage. 4. *Right ureteral disease* was considered but not kept in mind, in spite of the increased urination associated with the beginning of the pain and the radiation of the acute pain to the right lumbar area; the pain was not of the colicky type characteristic of ureteritis or ureterolithiasis, and the urine was normal. 5. The possibility of a *ruptured viscus* was also rejected, in spite of the severe abdominal pain, the history of trauma and the palpable tender mass. It was noted that the patient could not remember the date of her last abdominal trauma—evidently it had occurred a good while before the onset of the severe abdominal pain. In addition, there was no fever and no leukocytosis. 6. *An acute pelvic infection* was suggested by the full and tender right adnexae, but this was rejected because there was no history of venereal disease and no leukorrhea, and the pain was unusually severe for this condition. 7. A *ruptured aneurysm* of the right deep epigastric blood vessels was also suspected, in view of the history of repeated old abdominal trauma, which might have predisposed to this accident. The diagnosis was not thought valid, however, because the patient had not noticed any thrill or throbbing prior to the onset of acute pain. (In taking a history, however, one should keep in mind that a patient may not be very observant about such a sign as a thrill, especially when the abdomen is thick.) 8. The history of *prolonged bleed-*

*ing after tooth extraction* a year earlier, and the unusual bleeding from the hand scratch the month previous, suggested that there might be some *intraperitoneal or extraperitoneal abdominal disease* consequent to blood dyscrasia. The diagnosis was not seriously considered, since there had been no spontaneous bleeding of the mucous membranes or the skin. Nor had there been any history of serious petechiae or ecchymosis on any part of the body, except the occasional hematoma that resulted from bumping the right hip and the illiac region.

A comparison of these differential diagnostic possibilities with the true lesion illustrates how the acute abdominal symptoms attending a hematoma of the lower rectus can easily hoodwink even the most careful abdominal surgeon. The exact pathologic condition in this case also remains unexplained. Possibly it was due to a ruptured aneurysm of a deep epigastric vessel, subsequent to repeated old contusion with hematoma. The patient may easily have missed the important "thrill" or throbbing sensation prior to the acute attack of pain. Again, some blood dyscrasia or weakening of the blood vessel walls, particularly of the deep epigastric vessels, is certainly possible; the history of prolonged bleeding gives support to this view. It should also be noted, however, that the bleeding and coagulation times were normal, both immediately after the operation and six days later. The platelet count would normally be expected to show an increase immediately after the operation, and it did so, reading 468,000 —a definite increase. Yet this would be unexpected in any bleeder's disease, for in the presence of such a condition neither operation nor any active bleeding will produce much increase in the platelet count.

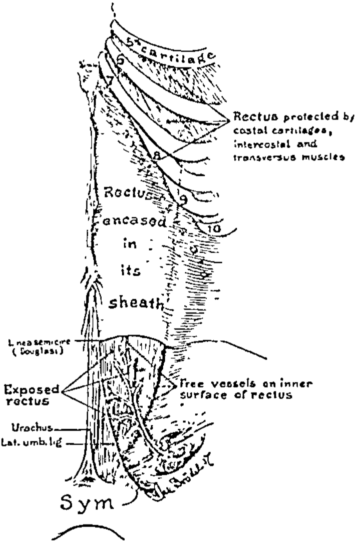
5th cartilage
6
7
8
9
10
Rectus protected by costal cartilages, intercostal and transversus muscles
Rectus encased in its sheath
Linea semicirc (Douglasi)
Exposed rectus
Free vessels on inner surface of rectus
Urachus
Lat. umb. lig
Sym
Brödel

Fig. 3.—Vulnerability of dorsal surface of lower rectus. *Reproduced by permission of the Johns Hopkins press from Brodell, op. cit.*

*The final diagnosis, therefore, was intramuscular hematoma of the right lower rectus abdominis, probably secondary to rupture of a deep epigastric aneurysm or to some blood dyscrasia of undetermined cause.*

One may thus reemphasize the importance of a careful and detailed case history in the diagnosis of this condition. The examining physician must, of course, have the possibility in mind in any case of abdominal pain following an injury or exertion, even if slight, and certainly when there is a palpable mass. But even when this possibility is kept in mind, he may easily misdiagnose the condition by overlooking the presence of trauma, muscular weakness or other predisposing conditions when these are not definitely reported. Indeed, it may take persistent questioning to insure that the patient will recall such incidents. An example is the case reported by Kapsinow:

"The patient was a white woman, aged 64, with persistent pain and a lump in the right lower quadrant. The correct diagnosis was confused by the patient's obesity, which made palpation difficult, by the absence of tenderness, lack of any history of trauma, and history of repeated appendicitis attacks. Operation revealed clotted and oozing blood in the right rectus muscle, and since the patient was under spinal anesthesia, she was questioned further regarding trauma. Only then was it learned that the first sharp pain in the right lower abdomen had occurred when she had attempted to turn the mattress of her bed by herself. The author concludes: 'The interesting features in this case were the apparent insignificance the patient placed upon the trauma as the cause of her trouble, the slowness in the development of the mass and the history of repeated attacks of appendicitis'."

Another interesting case in point is one reported by Vilar, in which the origin of the hematoma was obscure and the beginning of the process completely painless:

"The patient in this instance was a colleague, who one day happened to feel his abdomen and noticed in the right iliac fossa a tumor which seemed to be appendicular. At this time it was absolutely painless. Three months later it had developed to a hard tumor, and was somewhat painful. Vilar states: 'The patient was now questioned more carefully on the antecedents, and remembered having noticed a bruise in the affected region about a month before the beginning of the process. This he attributed to some bump against the furniture.' The author then surmised that the minute trauma might have determined the appearance of the process in a weakened area, or more probably, the ecchymosis was due to blood passing from a hematoma thru the orifices of the anterior rectus sheath to the subcutaneous tissues. A hematoma within the rectus sheath was thus suspected. The tumor was removed surgically shortly afterwards. It is also interesting that in this case, the spontaneous hematoma had evolved to aseptic suppuration, which explained the hardness to palpation."

Another case in which a tender abdomen made the correct diagnosis difficult was reported by Keller. This is also interesting because the patient was a 19-year-old girl.

"The pain in both lower quadrants was so excruciating and the abdomen so tender that a differential diagnosis could not be made by rectal examination. The tentative diagnosis was (1) acute appendicitis, (2) torsion of right ovarian cyst, (3) in view of a vaginal discharge, right pyo- or hemosalpinx. On operation, a formed clot was found immediately under the superficial fascia, and the right rectus totally torn and bleeding four to five finger breadths above the symphysis pubis. The torn sheaths were pulled together without touching the muscle fibers. Eight weeks after discharge, the abdomen showed no limitation of movement in the area."

In view of this history, the author points out that rectus hematoma should be considered in the differential diagnosis when there is no history of pelvic disease, the general health is unaltered, there is no fever, and no signs of serious abdominal conditions are present, such as serious peritoneal involvement.

*Treatment.*—Hematomas of the rectus abdominis have been treated with success by conservative measures as well as by operation. Although the latter treatment is more frequent, many operations have been undertaken to clarify a doubtful diagnosis, or in the expectation of encountering some other condition.

On the other hand, considerable numbers of patients in whom hematomas developed because of trauma during military training were given conservative treatment and recovered, without exception. Notable are two series totaling 59 patients (Bowers and Richard; Fruin and McLaughlin).

Teske has summarized the indications for conservative treatment. The patient should be young, the hematoma small and of traumatic origin, and the muscle and arteries be normal. Treatment consists of the application of ice bags, bed rest, and the administration of sedatives. A hot water bottle or compress may be used when danger of further hematoma is past.

Operative intervention is indicated when there is abscess or repeated hemorrhage; exporatory operation is indicated if the diagnosis is unclear. In these conditions, the earlier the operation the better, as the hematoma may spread with delay, and the anatomic nature of the region permits it to become quite large.

A paramedian incision may be made directly over the palpable mass. The sheath is usually opened and the muscle split, if necessary, to remove the clot. If spurting or oozing vessels are discovered, they should be ligated above and below the point of bleeding. Bleeding from the muscle may be checked with mattress sutures of catgut. It may be necessary to drain the opening if there are torn and oozing muscle ends. Closure without drainage is preferable and is usually possible when the area is dry and free from infection. As a rule the peritoneum is not opened unless the hematoma has extended into the abdominal cavity or there are intra-abdominal complications.

Sometimes the clot is so intimately imbedded in the muscle that it cannot be evacuated. When it is inconvenient to remove the hematoma and the patient's condition is favorable, the mass may be left *in situ* and treated conservatively. Even large masses have been treated in this way with success.

In a case reported by Gerstman, a hematoma developed in a pregnant woman aged 24 shortly before the commencement of labor. The similarity to a threatened rupture of the uterus indicated cesarean section, which revealed a large hematoma within the muscle fibers, extending from the symphysis to the umbilicus. The baby was delivered successfully, and the hematoma was not removed but was treated conservatively. There was a slight infiltration at the site of the hematoma when the patient left the hospital, but four weeks

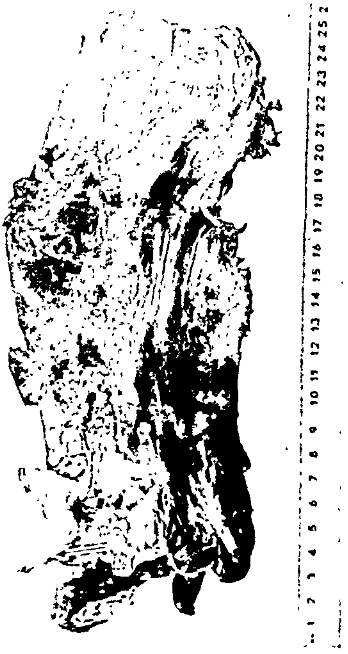

Fig. 4.—Hematoma of rectus muscle. Posterior aspect and [illegible] the [illegible] the inferior [illegible] *duced from* [illegible]

later she stated that she was feeling well.

## SUMMARY

1. A case of hematoma of the rectus abdominis in a 35-year-old woman is reported. Smarting symptoms apparently began a week before admission, with gradually increasing painful paroxysms. Pain on admission was extreme. Clinical and roentgen observations suggested a twisted ovarian cyst or some other soft tissue structure. Operation revealed the hematoma, which was evacuated. The cavity was packed with gauze later removed fractionally. Recovery was uneventful. Possible etiologic factors, suggested by the case history and examination, were repeated slight contusions, rupture of an epigastric aneurysm and undetermined blood dyscrasia.

2. A review is presented of the anatomic and etiologic background, diagnosis and treatment of this type of hematoma, which so often mimics intra-abdominal disease.

3. Comparable cases from the literature are also reviewed with a view to their bearing on the differential diagnosis. It is emphasized that a careful and searching case history may unearth half-forgotten factors, such as slight contusions, strains, and signs of slight blood dyscrasia, which may suggest the correct diagnosis. Patient and repeated inquiry is therefore necessary in any case of abdominal complaint of dubious diagnosis.

## RÉSUMÉ

1. L'auteur rapporte un cas d'hématome du muscle abdominal droit chez une femme de 35 ans. Des symptômes progressivement douloureux débutèrent une semaine avant son admission à la clinique. A l'entrée, la douleur était extrême. Les examens cliniques et radiographiques firent penser à un kyste de l'ovaire tordu. L'opération révéla un hématome. Guérison.

2. On passe en revue l'étiologie, l'anatomie, le diagnostic et le traitement de ce type d'hématome qui simule si souvent une maladie intra-abdominale.

3. On discute le diagnostic différentiel et on insiste sur une anamnèse qui doit être bien fouillée, car elle découvre parfois des contusions oubliées, des signes discrets de dyscrasie sanguine etc.

4. La progession de la maladie est un facteur important dans le pronostic.

5. A la lumière des connaissances actuelles, les tumeurs à cellules de Hürthle devraient être suspectées de malignité.

6. L'extirpation totale du cancer de la thyroïde est le traitement idéal. Si le cancer est inopérable, on le traitera par les rayons X (haut voltage).

## ZUSAMMENFASSUNG

1. Es wird über einen Fall von Bluterguss im M. rectus abdominis bei einen 35 jährigen Frau berichtet. Schmerzhafte Erscheinungen setzten offenbar eine Woche vor der Krankenhausaufnahme ein und steigerten sich allmählich zu heftigen Schmerzanfällen. Bei der Aufnahme bestanden unerträgliche Schmerzen. Die klinische Untersuchung und Röntgenaufnahmen liessen eine gedrehte Eierstockszyste oder eine andere Weichteilsgeschwulst vermuten. Die Operation brachte das Hämatom zutage, das entleert wurde. Die Höhle wurde mit Gaze ausgefüllt und später stückweise entfernt. Genesung erfolgte ohne Zwischenfälle. Als mögliche ursächliche Faktoren wurden auf Grund der Anamnese und der Untersuchung wiederholte leichte Quetschungen, ein geplatztes epigastrisches Aneurysma und unbestimmte Bluterkrangung in Erwägung gezogen.

2. Es wird ein Überblick über die anatomischen und ätiologischen Hintergründe und über die Diagnose und Behandlung dieser Form des Blutergusses, die häufig eine innere Baucherkrankung vortäuscht, gegeben.

3. Ferner wird auf ähnliche Fälle in der Literatur mit Berücksichtigung ihrer Bedeutung für die Differentialdiagnose eingegangen. Es wird hervorgehoben,

dass eine sorgfältige Anamnese halb vergessene Tatsachen wie leichte Quetschungen, Zerrungen und Zeichen geringfügiger Bluterkrankungen ans Tageslicht bringen und auf diese Weise zu einer richtigen Diagnose leiten kann. In jedem Falle von unklaren Bauchbeschwerden ist Geduld und wiederholte Befragung des Kranken notwendig.

### RIASSUNTO

1. Viene descritta un'osservazione di ematoma del muscolo retto in una donna di 35 anni, nella quale i disturbi cominciarono una settimana prima con parossismi dolorosi ingravescenti. Al momento dell'ingresso il dolore era terribile; si pensò alla torsione di una cristi ovarica. All'intervento si trovò l'ematoma, lo si svuotò e la cavità fu riempita di garza. Guarigione. Si crede che la causa sia rappresentata da traumi minimi ripetuti, o da rottura di un aneurisma dell'arteria epigastrica o da una sindrome discrasica ematica.

2. Viene trattata l'anatomia, l'etiologia, la clinica e la cura dell'affezione, che così da vicino simula affezioni intraddominali.

3. Vengono raccolti dalla Letteratura casi analoghi. Si sottolinea la necessità di un'indagine anamnestica accurata per raccogliere elementi eventualmente dimenticati, quali piccoli traumi, segni minimi di emodiscrasia, ecc.

### SUMARIO

1. É apresentado um caso de hematoma do rectus abdominis numa mulher de 35 anos de idade. Os sintomas de dôr começaram aparentemente uma semana antes de sua admissão ao hospital, com paroxismos dolorosos gradualmente progressivos. A dôr era extrema por ocasião da internação. Observações clínicas e radiológicas sugeriram uma torção de cisto de ovário ou de uma estrutura similar móle. A operação revelou presença de hematoma, que foi retirado. A cavidade foi enchida de gaze, depois removida fraccionadamente. O restabelecimento decorreu sem incidentes. Possíveis fatores etiológicos sugeridos pela história do caso e pelo exame físico, contusões leves repetidas, ruptura de um aneurisma epigástrico e a discrasia sanguínea indeterminada.

2. É apresentada uma revisão da base anatômica e etiológica, diagnóstico e tratamento dêste tipo de hematoma, que tão freqüentemente imita a afecção intra-abdominal.

3. Casos comparáveis da literatura também são revistos especialmente com relação ao diagnóstico diferencial. É frizado que a anamnese cuidadosa da doença poderá revelar fatores semi-esquecidos, como as contusões leves, os excessos e sinais de discrasia sanguínea leve, que podem sugerir o diagnóstico correto. O inquérito paciente e repetido é portanto necessário em qualquer caso de queixa abdominal de diagnóstico duvidoso.

### RESUMEN

1. *Se comunica un caso de hematoma del músculo recto anterior del abdomen en una mujer de 35 años de edad. Los síntomas aparecieron una semana antes de su ingreso, con paroxismos dolorosos graduales. El dolor era muy intenso al ser admitida. La observación clínica y roentgenológica sugirió un quiste ovárico con pedículo torcido. La operación reveló el hematoma que fué evacuado. La cavidad fué taponada con gasa que posteriormente fué desalojada fraccionadamente. La recuperación se llevó a cabo sin accidentes ni complicaciones. Se sugieren posibles factores etiológicos por la historia y examen físico del caso, contusiones ligeras repetidas, ruptura de un aneurisma de la epigástrica y discrasia sanguínea no determinada.*

2. *Se presenta una revisión desde el punto de vista anatómico y etiológico, diagnóstico y terapéutico en este tipo de hematoma que presenta tan frecuentemente la enfermedad intraabdominal.*

3. *Se revisan también casos similares comunicados en la literatura, refiriéndose [illegible] diferencial [illegible]*

ligeras, esfuerzos y signos de discrasias sanguíneas, que pueden sugerir el diagnóstico correcto. El interrogatorio paciente y cuidadoso, es por lo tanto necesario en cualquier caso de molestia abdominal de diagnóstico dudoso.

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# Cardiac Rupture During Heart Massage

## Ventricular Standstill Following Administration of Procaine Amide

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THE great emotional appeal and the dramatic results of the treatment of cardiac arrest have captured the attention of many investigators. The knowledge thus gained aids in the understanding of the causes of cardiac stoppage and makes possible physiologically sound prophylaxis and treatment of uncomplicated cardiac arrest.

Little is known, however, about the complications resulting from the treatment of cardiac heart standstill. The purpose of this paper is to bring to the reader's attention some of the possible complications arising during a treatment of cardiac arrest, as illustrated by a clinical case.

### REPORT OF CASE

A 74-year-old white woman, small and emaciated but mentally alert, was admitted to Aultman Hospital complaining of abdominal enlargement, moderate shortness of breath on exertion, occasional heart palpitation and, recently, swelling of both ankles.

A colloid nodular goiter was present. The heart was somewhat enlarged to the left; systolic and diastolic murmurs were heard over the aortic area; the rate was regular, 110 per minute; the blood pressure in millimeters of mercury was 132 systolic and 50 diastolic, and the pulse was hard. The respiratory rate was 24 per minute. The abdomen was enormously enlarged, containing loculated fluid, of which 21,000 cc. was removed on admission. Cytologic examination revealed malignant cells.

An electrocardiogram revealed sinus tachycardia, absence of the R wave in V2, a P-R interval of 14 and a QRS of 0.08.

But for the signs of moderate hepatocellular damage, the blood chemical values and blood electrolytes were within normal limits. The blood count revealed marked anemia, lymphopenia and leukocytosis. The sedimentation rate was elevated, and the platelet count was normal.

After the usual preparation with blood transfusions, vitamins, electrolytes and fluids, as well as prophylactic administration of antibiotics, the patient was operated on for intra-abdominal malignant tumor. Preanesthetic medication consisted of 0.2 Gm. of chloral hydrate, 0.005 Gm. of morphine and 0.0005 Gm. of atropine; 12 mg. of Pantocain in 10 per cent dextrose was used for spinal anesthesia; this was injected into the fourth lumbar interspace and reached the level of the xyphoid process.

Within ten minutes after the induction of spinal anesthesia, a fall of blood pressure from 150 systolic and 70 diastolic to zero was noticed by the anesthetist. The radical pulse became unobtainable; the respirations ceased, and the skin incision stopped bleeding.

The left half of the diaphragm was palpated through the incision in the peritoneum, and the pericardium was then exposed through a separate incision in the fifth intercostal space to the left of the sternum. No bleeding from this incision was encountered, and the heart was in standstill.

Cardiac massage was begun; oxygen was supplied by endotracheal tube, and the blood pumped into the cubital vein, positive pressure being used.

Within five minutes the heart resumed its action, but the beat soon became weak, and a second standstill occurred ten minutes later. The pericardium was then incised, and a small, flabby heart was discovered in asystole. It was grasped with the right hand, the surgeon standing to the right of the patient, and the massage was resumed. Five-tenths cc. of 1:1, 000 aqueous solution of epinephrine was in-

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jected into the right ventricle, to which the heart, almost immediately, responded by a strong and regular action. Two minutes later ventricular fibrillation began. The fibrillation was interrupted by injection of 2 per cent procaine hydrochloride into the right ventricle.

A pool of venous blood in the pericardial sac was noticed during the ensuing standstill, and a 2 cm. tear near the apex of the anterior wall of the right ventricle was detected. The leak was controlled by two No. 00 chromic catgut figure-of-eight sutures. The cardiac massage resumed, and this was followed immediately by resumption of cardiac activity. A cycle of regular cardiac action followed by ventricular fibrillation, standstill, massage and regular heart activity then became established, and lasted for the next thirty minutes. The duration of regular cardiac activity increased with each period, and, though no pulsation of the radial artery was palpable, the color of the skin remained normal, the pupils were contracted and pulsations of the thoracic portion of the aorta became increasingly stronger. Fifty minutes had elapsed since the beginning of resuscitation, when, after a prolonged period of satisfactory cardiac action, ventricular fibrillation reappeared. Two hundred mg. of procaine amide (Pronestyl®) was administered slowly by vein. Within two minutes of the injection the fibrillation ceased abruptly. *The instantaneous effect was similar to that* of the electric defibrillation observed in dog experiments. The cardiac standstill was now irreversible, and no amount of massage, either alone or supplemented by injections of epinephrine could start the heart.

Pertinent observations at the autopsy were as follows: The operative diagnosis of intra-abdominal malignant disease was confirmed by demonstration of papillary cystadenocarcinoma of the right ovary, metastatizing to the peritoneum, liver and lungs. Moderate atherosclerosis was observed, also in the coronary vessels. The myocardium was soft, light brown. The terminal branch of the left coronary artery seemed to be occluded. A 2.5 cm. sutured tear was noted in the anterior wall of the right ventricle. Microscopically the myocardial fibers appeared to be swollen, indistinct in outline and with increased perinuclear pigment. The interstitial tissue was edematous and contained areas of hemorrhage and foci of fibrosis. Sections through the ruptured myocardium showed recently extravasated red blood cells. Fibrosis was marked in the general area of the rupture.

*Comment.*—The many factors capable of leading to functional insufficiency of the heart, commonly called "cardiac arrest," may be considered to form two groups: factors causing interference with cardiac impulse and factors changing the physiologic response of the heart muscle.

Hyperactivity of the carotid sinus, the stimulation of that organ by pressure, manipulation around the aortic arch and direct stimulation of the vagus nerve, form the first group of factors. The second group is represented by hypoxia of the myocardium, due to anoxemia or ischemia; electrolyte imbalance; disturbance of hormonal balance, and the pharmacologic effect of certain drugs which change the response of the heart muscle to cardiac impulse.

There seems no reason to believe that factors of the group mentioned first were operative in the case reported here. No manipulations were carried out anywhere near the vagus nerve or the carotid sinus, and the patient responded well after the positioning on the operating table. The preoperative investigation failed to reveal any electrolyte deficiencies, (especially, no hypopotassemia was present) ; no signs of hormonal imbalance were detected, and no signs of anoxemia were noted. No drugs were used which were known to change the myocardial response. There was, however, a history of cardiac embarrassment, elicited on admission, pointing toward possible myocardial ischemia. This condition could only be aggravated by hypotension resulting from the spinal anesthesia[1] and reducing the coronary blood flow.

The etiologic factor leading to cardiac standstill in the case presented seems, therefore, to have been *myocardial ischemia following hypotension resulting from spinal anesthesia.*

Because the diagnosis can be made only by direct palpation or visualization of the heart, exposure of the heart should be the first rather than the last step in the effort to diagnose suspected cardiac standstill.

In the case reported the diagnosis was suspected from collapse of the peripheral circulation, absence of bleeding from the operative incision and failure to palpate a pulsating heart through the diaphragm. The diagnosis was established by exposing the pericardial sac through a thoracic incision.

Propulsion of oxygenated blood, the first goal of treatment of cardiac arrest, was achieved by extrapericardial massage, endotracheal intubation, artificial respiration and blood transfusion. The pupils remained contracted, and the skin resumed its natural color.

Although a sharp blow against the pericardium might be sufficient to start a heart at standstill,[2] the logical requirement for resumption of sustained cardiac activity is satisfactory oxygenation of the myocardium. This was apparently inadequate in the reported case. The heart resumed its action within minutes after the beginning of cardiac massage, but came to a standstill a second time ten minutes later. Even direct massage of the heart was unsuccessful in this instance. Intracardial injection of epinephrine was followed by immediate resumption of cardiac activity; but it also had originated a cycle of regular action followed by ventricular fibrillation, injections of procaine hydrochloride, standstill, massage and regular action again.

While the intramyocardial injection of procaine hydrochloride, in the absence of an electric defibrillator, can be accepted as a necessary measure, the wisdom of injecting epinephrine is questionable. The weak and flabby heart muscle of the patient in the case here reported, however, was apparently unable to provide a systole vigorous enough to ensure adequate oxygenation of itself, thus justifying the use of a cardiac "whip."

A balance between the oxygen requirement and the oxygen supply must have been achieved, for the cardiac standstill remained reversible, and the skin well colored, and the periods of regular cardiac activity lasted longer with the duration of resuscitation.

### GENERAL COMMENT

*Rupture of the Heart During Cardiac Massage.*—The danger of a crushing injury to the massaged heart is real and increases with the force exerted to compress the heart and with the extent of any myocardial damage that may be present prior to treatment. The cause of the injury may be the sudden impact of the grasping hand, the pressure of the surgeon's fingers, or the gliding movements of the surgeon's hand. Lack of synchronization of the massaging movements with the incipient cardiac action further increases the possibility of trauma.

To my knowledge, only 2 cases of cardiac rupture during heart massage have been reported,[3] though ecchymosis, hemorrhage and hemorrhagic necrosis resulting from heart massage have been described as occurring both in animal experiments[4] and in man.

The lack of information about the case of cardiac rupture mentioned by Johnson and Kirby[3a] does not permit its comparison to the case reported here. It seems noteworthy, that their patient was 74 years of age and that the rupture occurred after the pericardial sac was entered.

The cardiac rupture reported by Hurwitt[3b] occurred in a 69-year-old woman known to have had arteriosclerotic heart disease. The pericardial sac was entered, and it was the surgeon's impression that his thumb had penetrated the myocardium through an area of fatty infiltration; this was later microscopically confirmed. The patient in the case reported here was also an elderly [illegible] woman with [illegible] myocardial [illegible] the pericardium did not result in rupture of the heart, as was evidenced by the absence of blood in the pericardial sac when this was later entered. The leak was noted after massage had been applied directly to the heart.

The mechanism of the rupture remains uncertain. Laceration of the myocardium is known to have followed blunt injury to the heart,[6] and spontaneous rupture of the heart may be due to a sudden increase of intracardial pressure or scattered myocardial hemorrhages.[6a] The continuity of the muscle bundles in the heart is such that the application of sudden tension at one point may result in a rupture at a considerable distance from it, thus making the site of the laceration a rather unreliable evidence of its causation. The rupture in the case here presented occurred through the anterior wall of the right ventricle and in an area of increased focal fibrosis. It was the surgeon's impression that he did not enter a cavity with any of the massaging fingers.

It seems improbable that spontaneous rupture should occur in a weak and flabby heart muscle; this suggests that the injection of epinephrine immediately prior to the massage that led to rupture may have had etiologic importance. The sudden change in the muscle tonus and the trauma of the injection, as well as the resulting increase in intracardiac pressure, may well have been important, if not decisive, factors leading to cardiac rupture.

The management of cardiac laceration during a massage of the heart does not differ from treatment of a myocardial tear occurring under different circumstances. Elaborate procedures are obviously unnecessary, and the tear should be closed with a few sutures placed through the thickness of the myocardium, the branches of coronary vessels being avoided. The marked friability of the heart muscle does not permit the use of clamps or forceps.

The suturing of the myocardium had no apparent effect on the cardiac activity, which is not surprising in view of the known tolerance of the heart muscle to mechanical injury.

In all 3 reported cases the rupture followed direct massage of the heart and occurred in elderly persons with disease of the myocardium. In the 2 cases reported in more detail, injection into the myocardium had been made prior to the rupture. Hurwitt[3b] injecting calicum chloride, and epinephrine being used by myself. It remains unknown whether the drug injected or the stimulus of the injection, or both, contributed to the causation of cardiac rupture.

In view of those observations, it seems appropriate to warn against entering the pericardial sac and against intracardiac injections during the treatment of cardiac arrest in elderly patients with diseased hearts.

*Ventricular Standstill Following Intravenous Injection of Procaine Amide.*—The known effect of procaine amide, which makes that drug so valuable in the treatment of cardiac arrhythmias, consists mainly in depression of ventricular activity by reducing ventricular conductivity, depressing the basic idioventricular pacemaker,[7] and increasing the threshold for stimulation of the myocardium.[8] The exaggeration of this effect results in ventricular asystole, as demonstrated both in animal experiment[9] and in man,[10] and leading to a fatal outcome in some cases.[11] In many cases the drug was used in dying patients, thus making impossible a reliable evaluation of its role. However, a causal relation between a cardiac arrest and the intravenous administration of procaine amide was satisfactorily demonstrated by Weingarten.[10c]

The effect of intravenously injected procaine amide was observed directly on the exposed heart in the case reported here.

Within two minutes after an intravenous injection of 200 mg. of procaine amide (Pronestyl®) ventricular fibrillation stopped quite abruptly, the ventricles remaining still and in diastole. The standstill was irreversible, as no amount of massage, either alone or supplemented by injections of epinephrine, was successful in starting the heart again.

The damage to the patient's liver, as demonstrated by preoperative investigation, might have been a factor in her response to a moderate dose of procaine amide. The poor condition of her heart, due both to the underlying disease and to prolonged effects toward resuscitation, might well have been the cause of the terminal cardiac standstill. However, the abruptness of the end, the short time that elapsed between the injection and the ventricular standstill and the known effect of the drug point to a possible causal relation between the intravenous administration of procaine amide and cardiac standstill in this case.

A word of caution seems therefore to be warranted whenever the intravenous injection of procaine amide is being considered for elderly patients with known hepatic damage.[12]

## SUMMARY

A myocardial rupture was observed during the treatment of cardiac arrest by direct massage of the heart. Suturing of the myocardium had no observable deleterious effect on cardiac action. The resuscitation was terminated by an irreversible ventricular asystole following an intravenous injection of 200 mg. of procaine amide (Pronestyl®).

The causation, the diagnosis, and the treatment of cardiac arrest in the case presented are commented upon, and cardiac rupture, as well as the effect of procaine amide on the myocardium is discussed.

The following conclusions are suggested: In the treatment of cardiac arrest in elderly patients the massage should be extrapericardial; intramyocardial injections should be avoided, drugs sharply increasing the tonus of the heart muscle should not be used, and the indication for intravenous administration of procaine amide should be evaluated with extreme caution.

## RESUMEN

Se observó una ruptura del miocardio durante el tratamiento de paro cardíaco por masaje directo del corazón. La sutura del miocardio no tuvo efectos nocivos sobre la acción cardíaca. La resucitación se terminó por una asistolia ventricular irreversible siguiente a una inyección intravenosa de 200 mg. de procainamida (Pronestyl).

Se presenta y comenta la causa, diagnóstico y tratamiento del paro cardíaco en el caso, la ruptura cardíaca y el efecto de la procainamida sobre el miocardio.

Se sugieren las siguientes conclusiones: El masaje debe ser extrapericárdico en el tratamiento de los pacientes viejos con paro cardíaco; deben evitar se las inyecciones intramiocárdicas, no deben usarse las drogas que aumentan bruscamente el tono del músculo cardíaco y debe valorarse con extremo cuidado la indicación para la administracción intravenosa de procainamida.

## RIASSUNTO

Durante assaggio cardiaco diretto per arresto del cuore si verifico la rottura del miocardio. Venne eseguita una sutura senza che si creassero effetti dannosi sull'attività cardiaca. Il tentativo di risuscitazione terminò con una asistolia ventricolare irreversibile consecutiva a iniezione endovenosa di 200 mg. di procainamide (Pronestyl).

Segue un commento sul caso (causa, diagnosi e cura dell'arresto cardiaco) e sulla rottura del cuore, come pure sugli effetti della procainamide.

Vengono tratte le seguenti conclusioni: nella cura dell'arresto cardiaco in pazienti anziani il massaggio deve essere extrapericardico; si deve evitare ogni iniezione intra-miocardica; non si devono usare farnaci che aumentino sensibilmente il tono del muscolo cardiaco; le indicazioni per l'uso della procainamide debbono essere vagliate con estrema cautela.

### *RÉSUMÉ*

Description d'un cas de rupture du myocarde durant le massage direct du coeur pour arrêt du coeur. La suture du myocarde n'a pas eu d'effets nocifs secondaires sur la fonction cardiaque. Après réanimation, asystolie ventriculaire irréversible à la suite d'une injection intraveineuse de 200 mg de Pronestyl.

L'auteur commente la cause, le diagnostic et le traitement de l'arrêt du coeur dans ce cas, ainsi que l'effet du Pronestyl (procaine amide) sur le myocarde.

Conclusions: chez les malades d'un certain âge, le massage du coeur devrait être extrapéricardiaque; les injections dans le myocarde devraient être évitées, ainsi que les médicaments augmentant fortement le tonus du muscle cardiaque; les indications de l'administration intraveineuse de procaine amide devraient être posées avec la plus grande prudence.

### ZUSAMMENFASSUNG

Während der Behandlung eines Herzstillstandes mit direkter Herzmassage wurde eine Zerreissung des Herzmuskels beobachtet. Das Nähen des Myokardiums hatte keine sichtbaren Schädigungen der Herzaktion zur Folge. Die Wiederbelebung scheiterte an einer irreversiblen Asystole der Herzkammern, die nach intravenöser Einspritzung von 200 mg Prokainamid (Pronestyl) auftrat.

Die Ursache, die Diagnose und die Behandlung des Herzstillstands im vorliegenden Falle werden besprochen, und auf den Herzmuskelriss und auf den Effekt des Prokains auf das Myokardium wird eingegangen. Die Schlussfolgerungen sind, dass bei älteren Kranken mit Herzstillstand die Massage extraperikardial ausgeführt werden soll, dass Einspritzungen in die Herzmuskulatur zu vermeiden sind, dass Medikamente, die den Tonus des Herzmuskels plötzlich steigern, nicht angewandt werden sollten, und dass die Indikation zur intravenösen Verabreichung von Prokainamid mit äusserster Vorsicht und Zurückhaltung gestellt werden muss.

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When we survey the long development of mankind from a rare hunted animal, hiding precariously in caves from the fury of wild beasts which he was incapable of killing; subsisting doubtfully on the raw fruits of the earth which he did not know how to cultivate; reinforcing real terrors by the imaginary terrors of hosts and evil spirits and malign spells; gradually acquiring the mastery of his environment by the invention of fire, writing, weapons, and at last science; building up a social organization which curbed private violence and gave a measure of security to daily life; using the leisure gained by his skill, not only in idle luxury, but in the production of beauty and the unveiling of the secrets of natural law; learning gradually, though imperfectly, to view an increasing number of his neighbors as allies in the task of production rather than enemies in the attempts at mutual depredation—when we consider this long and arduous journey, it becomes intolerable to think that it may all have to be made again from the beginning owing to failure to take one step for which past developments, rightly viewed, have been a preparation . . .

The present moment is the most important and most crucial that has ever confronted mankind. Upon our collective wisdom during the next twenty years depends the question whether mankind shall be plunged into unparalleled disaster, or shall achieve a new level of happiness, security, well-being, and intelligence. I do not know which mankind will choose. There is grave reason for fear, but there is enough possibility of a good solution to make hope not irrational. And it is on this hope that we must act.

—*Russell*

# Clinical Anatomic Aspects of Radical Hepatic Surgery

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SURGICAL resection of a part of the liver is not a new operative procedure, although many are inclined to believe so because of the fact that it is a relatively infrequent one. As early as 1899, Keen[1] reviewed the world literature and found that a total of 76 cases of surgical removal of hepatic tumors had been reported up to that time, including 3 of his own cases. The first such case that he cited was described by Luis[2] in 1886, and it was exactly two years later (1888) that the first comprehensive study was carried out on the intrahepatic gross anatomy by means of the injection-corrosion technic by Rex.[3] Unfortunately, most of this work was related to mammals other than man and therefore did not contribute a great deal to the surgical anatomic knowledge of the liver. It did indicate, however, that gross anatomists were again becoming interested in this organ, since surgeons had shown the feasibility of resection of its parts.

Early interest in hepatic surgery reached its peak in 1897; 14 cases of partial hepatectomy were reported in that year alone. At that time Keen[4] stated, "The number of cases in my combined tables is not very large, but they are increasing in frequency as surgeons become more and more aware of the possibilities of hepatic surgery. Concerning the novelty of the operation, the great vascularity of the liver, and the fact that the abdomen has to be opened, a mortality of 15 per cent is quite a gratifying result. After my experience, I would hardly hesitate to attack almost any hepatic tumor without regard to its size."

In those earlier days, the technic used in the removal of hepatic tumors consisted of such methods as the use of the Paqueline cautery, the employment of large strangulating through-and-through mattress sutures, the use of elastic tourniquets tied around the base of the tumor, or the mass ligation of the vessels and ducts to that part of the liver which was to be resected. Such procedures are frowned upon as applied to most other parts of the body, but some are still utilized in the surgical treatment of hepatic disease, although there is actually little improvement in technic. The present-day methods of hepatic surgical therapy remind one of the extinct methods once utilized in surgical treatment of the lungs. It is of interest to note, with regard to this, that it was not until surgeons had shown the possibility of removal of the entire lung, or parts of it, that anatomists became interested in the intrapulmonary gross anatomic picture. Once this picture had been established, the more logical individual ligation technic was advocated for pulmonary resection.

There are other similarities between the lung and the liver, as was brought out in a previous communication.[5] Embryologically, both organs arise as entodermal outpouchings from the foregut, giving rise to central tubular structures, the bronchial and biliary passageways. The vascular structures are similar in that each organ receives two sets of afferent vessels, one that may be considered primarily nutritive (the bronchial and hepatic arter-

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ies), and one that may be considered as primarily functional (the pulmonary artery and the portal vein). Likewise, each organ possesses a single set of efferent vessels (the pulmonary and hepatic veins).

Anatomists and surgeons alike have observed that there is a segmental distribution of the bronchi, the bronchial arteries and the pulmonary artery in the lung. From an examination of 150 liver casts made by the injection-corrosion technic with the assistance of Drs. Schroy and Sorensen,[5] we have concluded that there is likewise a segmental distribution of the bile ducts, the hepatic artery and the portal vein in the liver. We feel justified in including the portal vein even though we have not statistically analyzed this structure in all our cast specimens. The portal vein has been the subject of numerous investigations, especially those of Rex,[3] Melnikoff,[6] Hjortsjö[7] and Elias and Petty.[8] From their illustrations and descriptions and from our observation of the limited number of casts (25) in which the portal vein remained intact after handling during the examination of the other systems, it is obvious that the portal vein follows a segmental distribution. We can add little to their results except our own terminology

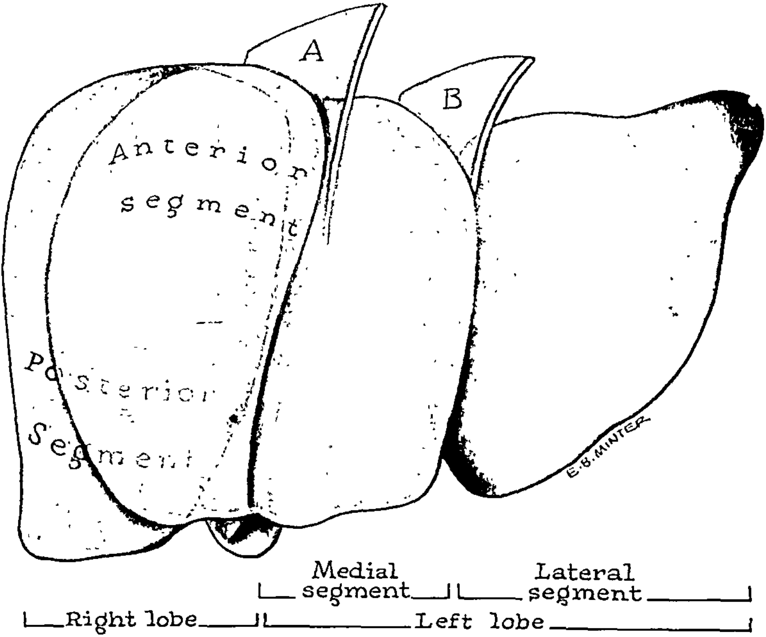

Fig. 1.—Diagrammatic illustration of the divisions of the liver, based upon the intrahepatic distribution of the segmentally arranged structures; i.e., the bile ducts, hepatic artery and portal vein. *A*, lobar fissure; *B*, left segmental fissure. The right segmental fissure divides the right lobe into an anterior and a posterior segment.

with regard to the branchings of the portal vein. In the lung, the main trunks of the pulmonary veins are not segmentally distributed in their course but mainly lie in the intersegmental planes; likewise, in the liver, the large hepatic veins follow an intersegmental course.

*Divisions of the Liver*—In those liver casts in which the segmentally distributed structures were injected, i.e., the bile ducts, the hepatic artery and the portal vein, one can distinguish a distinct fissure dividing the liver into its true right and left lobes. We called this fissure the "lobar fissure" (Fig. 1). On the visceral surface of the liver it corresponds to a line drawn through the gallbladder fossa below to the fossa of the inferior vena cava above. This is in contrast to the usual lobar division of the liver given in current texts. A second fissure, the right segmental fissure, can be observed in the right lobe, dividing this lobe into an anterior and a posterior segment. The left lobe was also divided by a fissure, the left segmental fissure, into a medial and a lateral segment; the latter corresponds to the left lobe as customarily used in gross descriptions of the liver (Fig. 1). Each of these four segments is further divided, according to its biliary drainage and vascular supply, into a superior and an inferior area or subsegment. The following section is a description of the prevailing pattern of branching of the vascular and biliary channels in the human liver.

*Prevailing Pattern of the Right Lobe*—1. *Bile Ducts* (Fig. 2): Two main ducts drain the right lobe. One of these, which we called the anterior segment duct, drains the region of the anterior segment; the other main duct drained the posterior segment, (posterior segment duct). Each of these segmental ducts was formed by the duct draining the superior area and the duct draining the inferior area of their respective segments. The two segmental ducts extend toward the porta hepatis, where they join to form a short right hepatic duct.

2. *Hepatic Artery* (Fig. 2): The right lobe is supplied exclusively by the right hepatic artery. In most of the casts (87 per cent), after arising from the common hepatic artery, it passes behind the common hepatic duct, and, just before it enters the hepatic parenchyma the right hepatic artery divides into an anterior and a posterior segment artery. Within the liver, these segment arteries join their respective bile ducts and terminate by dividing into superior and inferior area branches.

3. *Portal Vein* (Fig. 3): The right branch of the main portal trunk, like the duct and artery of this lobe, divides into an anterior and a posterior segment vein, and these in turn divide into superior and inferior branches.

*Prevailing Pattern in the Left Lobe*—1. *Bile Ducts* (Fig. 2): In the left lobe we also observed two main segment ducts. One of these drains the lateral segment of the left lobe (left lobe in the usual anatomic descriptions). This lateral segment duct is formed by union of the superior and inferior ducts of that segment; the union of the two ducts usually occurs in line with the fissure between the medial and lateral segments, i.e., the left segmental fissures.

The superior and inferior ducts of the medical segment coalesce to form a single medial segment duct. The latter joins the lateral segment duct to form the left hepatic duct.

2. *Hepatic Artery* (Fig. 2): The left hepatic artery arises as a terminal branch of the common hepatic and ascends obliquely upward and to the left in the porta for a short distance, then divides into a medial and a lateral segment artery. The medial segment artery descends into its segment and divides into superior and inferior area branches. The lateral segment artery extends to the fissure between the medial and lateral segments, where it divides into a superior and an inferior area branch.

3. *Portal Vein* (Fig. 3): The distribution of the left portal vein is somewhat different from that of the bile ducts and hepatic artery to this lobe. There are two

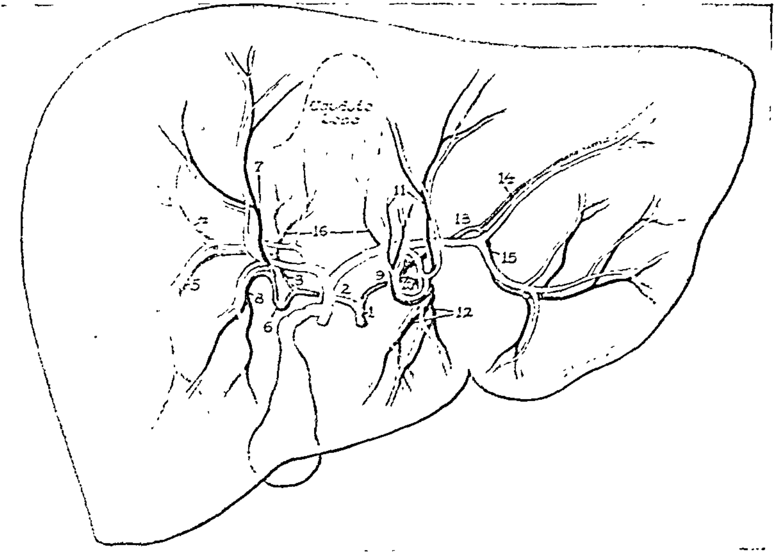

Fig. 2.—Composite drawing illustrating the prevailing pattern of branching of the bile ducts (light) and hepatic artery (dark). Although only the arteries are numerically indicated, the accompanying ducts carry a similar terminology. 1, common hepatic artery; 2, right hepatic artery; 3, posterior segment artery; 4, posterior-superior area artery; 5, posterior-inferior area artery; 6, anterior segment artery; 7, anterior-superior area artery; 8, anterior-inferior area artery; 9, left hepatic artery; 10, medial segment artery; 11, medial-superior area arteries; 12, medial inferior area arteries; 13, lateral segment artery; 14, lateral-superior area artery; 15, lateral-inferior area artery; 16, caudate lobe arteries.

parts of the left portal vein, as was emphasized by Elias and Petty:[4] a pars transversus, which lies in the hilus of the liver, and a pars umbilicus, which lies in the umbilical fossa.

In most instances there are two portal branches to the lateral segment. The vein to the superior area arises from the left side of the bend of the left portal vein as it descends into the umbilical fossa; the vein to the inferior area arises from the left side of the pars umbilicus.

The veins to the medial segment arise from the right side of the umbilical portion of the left portal vein. Usually these veins are multiple, from two to four being present. In most instances the two superior area veins and the two inferior area veins arise from common venous trunks.

*Prevailing Pattern in the Caudate Lobe*—1. *Bile Ducts* (Fig. 2): In accordance with its biliary drainage, the caudate lobe may be divided into a caudate process and a caudate lobe proper, the latter in turn being divided into a right and a left portion. Usually three ducts, one from each of the aforementioned parts, drain this lobe and empty into both the right and left hepatic duct systems.

2. *Hepatic Artery* (Fig. 2): The arteries to this lobe are more variable; from one to four branches [illegible]

nantly, however, two arteries supply the lobe. The branch to the caudate process and the right portion of the caudate lobe proper arises as a common trunk from the right hepatic branches; the branch to the left portion of the caudate lobe proper takes its origin from the left hepatic artery.

3. *Portal Vein* (Fig. 3): The portal vein branches, like the ducts, usually number three. The branch to the caudate process arises from the right main trunk, and the two branches to the caudate lobe proper from the left main trunk.

*Prevailing Pattern of the Hepatic Venous System*—As has been mentioned, the hepatic veins are not segmentally distributed as are the branches of the bile ducts, the hepatic artery and the portal vein; instead, they lie in intersegmental planes and drain adjacent segments. If one observes a cast in which the portal vein, the hepatic artery and the bile ducts are injected, the aforementioned fissures are clearly visible, but, if one observes a cast in which the hepatic veins are injected as well, one cannot distinguish these fissures, for the main trunks of the hepatic veins lie in the fissured areas.

Three main trunks of the hepatic veins may be distinguished; a middle hepatic vein, which lies in the lobar fissure; a left hepatic vein, which lies in the upper portion of the left segmental fissure, and a right hepatic vein, which lies in the right segmental fissure (Fig. 4).

Each of the three trunks drains the adjacent segments. The left hepatic vein

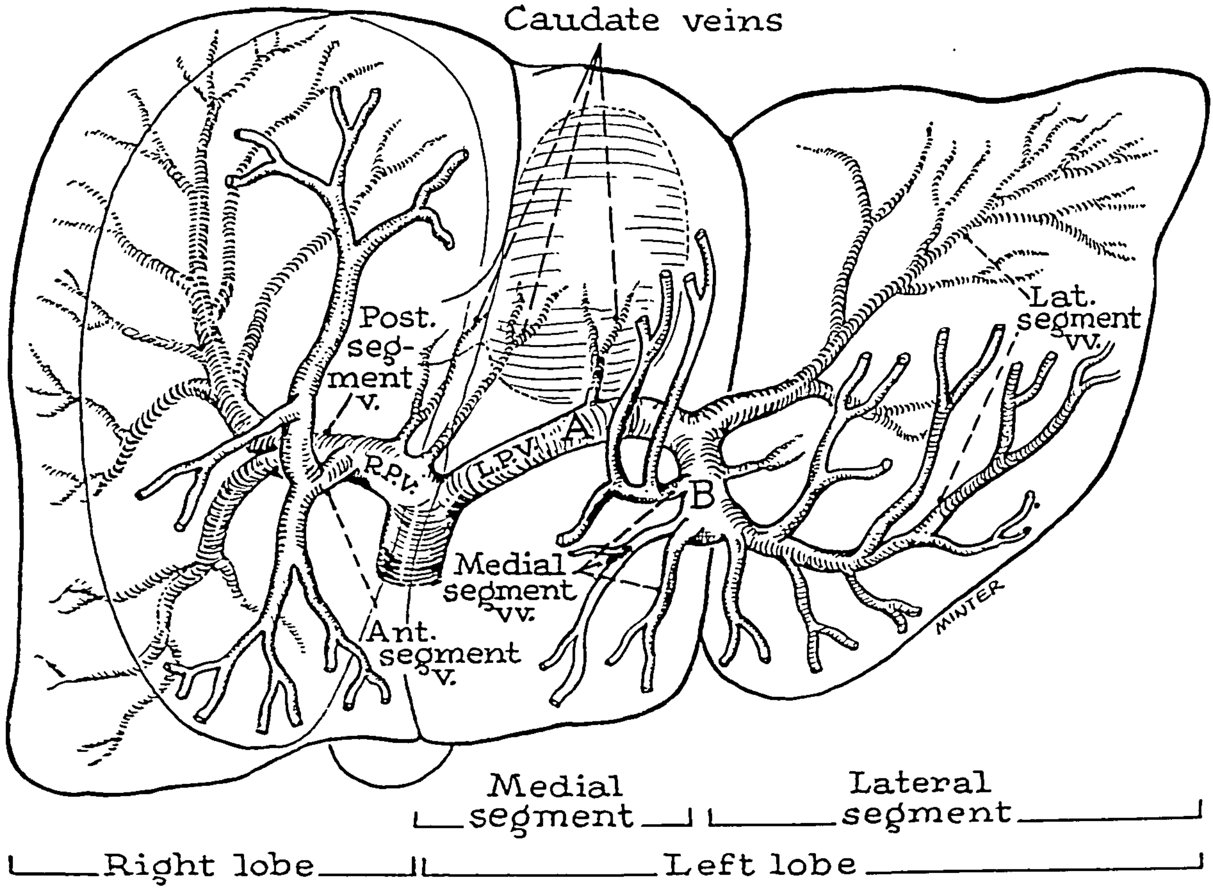

Fig. 3.—Intrahepatic distribution of the portal vein. *RPV*, right portal trunk; *LPV*, left portal trunk; *A*, pars transversus of left portal trunk; *B*, pars umbilicus of left portal trunk.

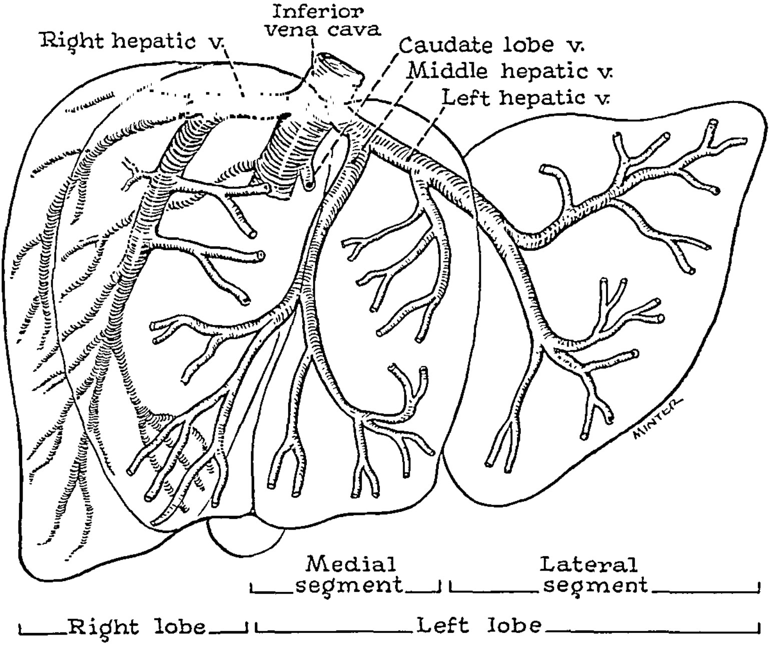

Fig. 4.—Prevailing pattern of the hepatic veins in the human liver (see text).

drains the entire lateral segment and the superior area of the medial segment. The right hepatic vein drains the entire posterior segment, plus the superior area of the anterior segment, and while the middle hepatic vein drains the inferior area of the medial segment and the inferior area of the anterior segment.

The right hepatic vein drains directly into the right side of the inferior vena cava where the latter lies in its fossa on the posterior surface of the liver. The middle and left hepatic veins, in the majority of cases, join to form a short common trunk, which enters the left side of the inferior vena cava at about the same level as the hepatic vein of the right side.

In addition to these main branches there are usually others that empty directly into the inferior vena cava. They include one or two constant branches that drain the caudate lobe, as well as inconstant branches that drain part of the posterior segment of the right lobe.

### COMMENT

Naturally, many variations are encountered with regard to the vessels and ducts within the liver, the discussion of which is beyond the scope of this presentation. These data do illustrate, however the fact that there is a prevailing pattern to the branchings of the vascular and biliary systems within the liver. It establishes a norm, and from this norm one may identify variant patterns.

With the knowledge of the intrahepatic branchings of the vascular and biliary channels, especially their segmental and intersegmental arrangement, hepatic resection may be approached with a brighter outlook. At present, owing to the unsatisfactory methods of hepatic hemostasis, many surgeons refuse to attempt eradication of a primary or secondary tumor, even though it may prolong or save the life of a patient. After individual ligation of the blood vessels and bile ducts to the segment or lobe to be resected, it seems logical to expect that one may resect through a relatively avascular interlobar or intersegmental plane. This has already been shown possible in the dog in the work of DeWeese and Lewis,[9] and also in man as demonstrated by Ravens[10] and Quattlebaum.[11] In fact, as early as 1888, Langenbuch[12] advised that incision for removal of the left lobe (restricted sense) be made in line with the falciform ligament, for in this plane one encounters much less bleeding. This plane is actually intersegmental, i.e. it lies through the left segmental fissure aforedescribed.

A partial resection of the liver based on sound surgical anatomic principles is certainly the most logical approach in the treatment of hepatic tumors—resection of an entire lobe, a segment or an area. Questions will undoubtedly arise similar to those heard when segmental resection of the lung was first advocated.

First would be the question as to how one can identify these divisions and subdivisions on the surface of the liver. In the lung, there are surface fissures that may mark off the lobes and at times the segments. One also finds fissures on the surface of the liver, especially on the visceral surface, which, if present, seem to mark off these segments or areas. I have not sufficiently analyzed these, however, to make any definite statement. In segmental resection of the lung, the intersegmental pulmonary vein is followed in order to identify the cleavage plane between segments; and, since the hepatic veins are also intersegmental, it is possible that these vessels may be utilized for the same purpose.

## SUMMARY

Although radical operations upon the liver were performed as early as 1886, little advancement has been made in the surgical technic of such resections. This is due mainly to the fact that surgeons (and anatomists) have been totally unaware of the intrahepatic course and distribution of the larger vascular and biliary channels and that, therefore, incisions through the hepatic parenchyma have been performed somewhat blindly. It is not surprising, therefore, that the present-day mortality rate for partial hepatectomies[14] is little changed from the mortality rate for similar procedures in 1897.[4]

It is the purpose of this presentation to emphasize the hope that, with the establishment of a prevailing intrahepatic gross anatomic pattern, radical operations on the liver may be performed on a more sound surgical-anatomic basis; i.e., by means of the individual ligation technic, thereby increasing operability and lowering the mortality rate associated with such procedures.

## ZUSAMMENFASSUNG

Obgleich schon im Jahre 1886 radikale Leberoperationen ausgeführt wurden, sind die Fortschritte in der chirurgischen Technik bei solchen Resektionen gering. Das liegt vor allem darn, dass die Chirurgen (und Anatomen) mit dem Verlauf und der Verteilung der grossen Blutgefässe und Gallengänge innerhalb der Leber völlig unvertraut sind, und dass infolgedessen Schnitte durch das Leberparenchym einen verhältnismässig blinden Vorgang darstellen. Es kann daher nicht überraschen, dass die heutige Sterblichkeit bei partiellen Leberresektionen sich von der aus dem Jahre 1897 bei ähnlichen Ein-

griffen wenig unterscheidet.

Die vorliegende Arbeit macht es sich zur Aufgabe, die Hoffnung zu erwecken, dass mit der Aufstellung eines vorherrschenden grob anatomischen Gefässmusters in der Leber radikale Eingriffe an der Leber auf Grund einer solideren chirurgisch-anatomishcen Basis ausgeführt werden können, d.h. mit Hilfe einer individuellen Unterbindungstechnik, und dass sich auf diese Weise die Operabilität erhöhen und die mit dem Eingriff verbundene Sterblichkeit herabsetzen lässt.

### RESUMEN

Aun cuando desde 1886 se han realizado operaciones radicales en el hígado, se han hecho pocos progresos en la técnica quirúrgica de las resecciones hepáticas, lo cual se debe principalmente, al hecho de que los cirujanos y anatomistas han pasado completamente desapercibido el curso intrahepático y distribución de los vasos sanguíneos y conductos biliares y por lo tanto, las incisiones hepáticas han sido bastante ciegas. Como consecuencia, no es sorprendente el encontrar que la mortalidad actual de la hepatectomía parcial[14] casi no a cambiado de la obtendida por procedimientos semejantes en 1897.[4]

Es el propósito de esta comunicación el señalar la esperanza de que, con el establecimiento de tipos de anatomía intrahepática, puedan llevarse a cabo operaciones sobre el hígado de acuerdo a una base más anatómica y quirúrgica, es decir, por medio de una técnica de ligaduras individuales, aumentando por ende la operabilidad y reduciendo el grado de mortalidad asociado a tales procedimientos.

### SUMARIO

Embora operações radicais do fígado tenham sido realizadas desde há muito tempo (1886), pouco progresso tem sido feito na técnica cirúrgica de tais ressecções. Isto é devido principalmente ao fato de que cirurgiões e anatomistas não tem tido conhecimento do trajeto e distribuição intrahepática dos canais biliares e vasculares maiores e que, portanto, incisões através do parênquima hepático têm sido mais ou menos cegas em sua realização. Como conseqüência, não é surpreendente constatar que a mortalidade atual das hepatectomias parciais não é muito diversa da mortalidade de processos semelhantes em 1897.

A finalidade desta apresentação é frizar a esperança de que, com o estabelecimento de padrão anatômico macroscópico intrahepático, predominante, as operações radicais do fígado possam ser realizadas numa base anátomocirúrgica mais perfeita, i.e., por meio da técnica individual de ligadura, aumentando assim a operabilidade e diminuindo a mortalidade associada a tais processos.

### RIASSUNTO

I primi interventi radicali sul fegato risalgono al 1886, ma ben scarsi progressi si sono fatti da allora, sopratutto per il fatto che chirurghi e anatomici non si sono mai resi conto della distribuzione intraepatica dei rami arteriosi e biliari, cosicchè le resezioni di parenchima sono sempre state fatte alla cieca. Non ci si deve, dunque, meravigliare se la mortalità attuale delle epatectomie parziali è poco diversa da quella che si aveva nel 1897. Vi è da augurarsi che con lo studio anatomico della vascolarizzazione intraepatica si potranno compiere gli intervento sul fegato con criteri anatomochirurgici solidi, e usando il metodo delle legature frazionate. Cresceranno, in tal modo, le possibilità chirurgiche e diminuirà la mortalità operatoria.

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To Lister and his followers the world was full of germs that must be attacked—in the air round the operation, on the instruments, hands, and clothing of the surgeon, in the operation field, and in the wound discharges afterwards. All germs were much alike, and except for a few striking examples like the bacilli of tetanus and anthrax the specific organisms responsible for infections of different types were not identified. Attention was concentrated upon killing the bacteria, and little was known of the defences of the tissues. Nevertheless, by such a simple faith, and by such crude methods as the carbolic spray, a revolution was effected that has probably never been paralleled in the realm of human endeavour. Wound fever and gangrene disappeared from the hospitals; childbirth was no longer an ordeal to be dreaded; compound fractures, which had formerly ended in death or amputation, united nearly as readily as simple ones.

With the fear of infection abolished, the way lay open to the exploration of all parts of the body and the addition of a third method, reconstruction, to the two standard procedures of surgery, drainage and excision. Surgeons were quick to embrace the opportunities thus presented to them. Before Lister, operations had been limited to the drainage of abscesses, amputations, the removal of stones from the bladder, and the excision of surface tumours. Within fifty years of his first tentative demonstrations every cavity had been explored, nearly every operation that is known to-day had been performed or projected, and countless diseases formerly hopeless had been brought within the range of curative surgery.

—*Ogilvie*

# Cardiopericardiopexy in the Surgical Treatment of Myocardial Ischemia

## The Operation and Its Results

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THE past two decades have witnessed startling developments in the scope of surgery, and the advances realized in cardiac surgery have been notable. Many have contributed to the surgical refinements attained in the various operative procedures advocated to reestablish adequate myocardial circulation, and these many approaches may be grouped into four surgical tenets: (1) the grafting of a vascular tissue to the myocardium (omentum,[1] lung,[2] skeletal muscle, mediastinal fat and spleen[3]); (2) arterialization of the coronary veins, as channels to increase oxygenation, by means of a vascular anastomosis;[4] (3) implantation of the internal mammary artery into the ventricular myocardium,[5] and (4) creation of a benign, permanent and chronic granuloma[6] between the visceral and parietal layers of the pericardium.[7] It is into the last-mentioned category that cardiopericardiopexy falls, and this paper is confined to a description of the procedure and a brief recital of its results.

A surgical operation for the relief of any physical disorder attains recognition and assumes therapeutic worth only after it has passed through a period of analysis and comparison. The relative simplicity or comparative complexity of the procedure, the various postoperative problems and sequalae that may complicate or hinder recovery, and the benefits derived from the operation must be known and equated against equivalent factors encountered in other medical or surgical procedures for the treatment of that same disorder. It is only after conformity with such an exacting formula that any form of surgical treatment can receive the stamp of endorsement.

What is cardiopericardiopexy, and how simple or complex is its execution? Of all the surgical procedures advocated for the treatment of diseases that have their basis in myocardial ischemia, cardiopericardiopexy is unquestionably the most modest in concept and the simplest to perform. The operation can be completed in thirty minutes or less. It is not necessary to open the pleural cavity. No intricate, time-consuming anastomosis, always involving the possibility of thrombosis, is required. It is a one-stage procedure. It does not demand special skills or talents other than those possessed by any well-trained and experienced general surgeon who is familiar with the anatomic and physiologic nature of the heart and the mediastinal structures. Incisions are not extensive and are not carried through heavy muscles rich with blood.

The operation of cardiopericardiopexy,[8] as performed, may be illustr[illegible] l best as taking place in [illegible] teps [illegible]

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tions *A*, *B* and *C*), as follows:

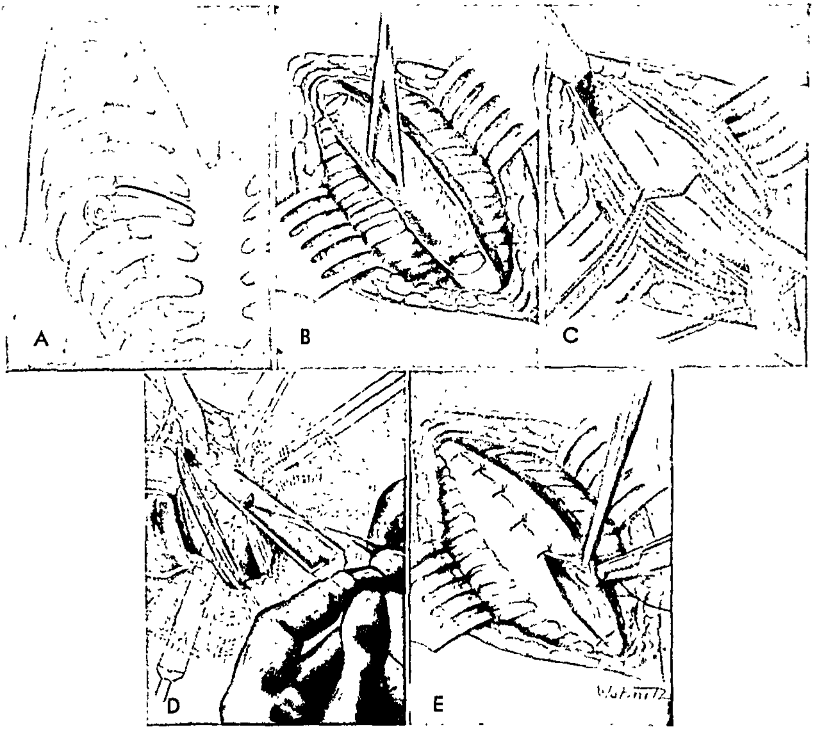
Step 1 (*A*) includes positioning of the patient, incision of the skin, and exposure and excision of the costal cartilage.

The patient is placed in the supine position. Beginning at the sternal border, a small cutaneous incision is made over the left fifth costal cartilage and is carried laterally along this cartilage to a length of approximately 7 or 8 cm. The incision is deepened carefully and carried down through the pectoralis muscles to expose the cartilage. The loss of blood is negligible. To remove a segment of cartilage, the perichondrium should be incised and stripped anteriorly and posteriorly. Some difficulty may be encountered in stripping the perichondrium from the cartilage, but whenever possible the perichondrium should be left intact. A 5 cm. segment of the cartilage is removed flush with the sternal border.

Step 2 (*B*) exposes the anterior mediastinum, including the pericardium. The posterior perichondrium is incised to a length of approximately 5 cm. This exposes a thin muscle layer, the transversus sterni, lying just deep to the posterior perichondrium, and these muscle fibers are separated by blunt dissection. The anterior mediastinum is a potentially "free" space, and the left pleura does not usually intrude into the field. When it does, it can be identified as a thin mass of soft tissue that bulges with each respiration, and it can be gently retracted laterally to obtain free exposure of the pericardium. The internal mammary vessels should be preserved, and they are retracted mesially.

In Step 3 (*C*) the pericardium is opened, the sac is explored, talcum powder is introduced and the surgical wound is closed. The pericardium is picked up carefully with two hemostats and an incision 2 to 3 cm. long, parallel to the skin incision, is made in an avascular area. Small retractors are placed at each end of the wound to elevate the pericardium and the chest wall. All pericardial fluid should be aspirated completely by means of a small rubber catheter. To explore the heart, the surgeon's index finger may be inserted into the pericardial sac; thus the presence of any infarcts or scars and the existence of any adhesions between the heart and the sac are noted. A special cannula is used to spread 2 to 4 drams (by volume) of sterile dry magnesium silicate powder (USP Talc) over the anterior surface of the heart and around its borders. Instead of the cannula, a coarse atomizer may be used to disseminate the dry powder over the surface of the heart. The pericardium is closed incompletely with fine catgut sutures. The perichondrium is then approximated. The incised muscles, connective tissue and skin are sutured together, layer by layer, without drainage.

What are the postoperative problems?[9] Shock arising from prolonged exposure and excessive handling of vital tissues and organs is never experienced. Although the problems encountered after the operation are unusual and peculiar to this procedure, they are almost always limited in number, extent and gravity and seldom terminate in death. These special problems may be grouped into those due to operative trauma, those due to foreign body reaction, and those due to the diseased condition of the heart. Postoperative pain is, on the whole, a minor complication; it is neither severe nor prolonged, persisting only for a few days, and may be controlled by the administration of sedatives and analgesics. The foreign body reaction, which is invoked by the talc introduced into the pericardial sac, reflects itself in a rise of temperature and involves the lungs, pleura, heart, pericardium and mediastinum. None of these complications is of sufficient gravity to endanger life. The temperature begins to rise from the first operative day, reaching an elevation often as high as 104 F. by



*A*, and *B*, cutaneous incision and excision of cartilage. *A*, position of patient and site and extent of cutaneous incision. *B*, incision carried down through pectoralis muscles to level of costal cartilage. The fifth cartilage has been stripped of its perichondrium and the cartilage removed. The posterior perichondrium is being split to expose transversus sterni fibers, and beyond these fibers lie the anterior mediastinum and the pericardium. *C*, opening of the pericardium. Pericardium exposed; small finger retractors placed at either end of incision are used to elevate chest wall and pericardium. An avascular area of the pericardium has been grasped with hemostats and incised. The pericardial incision is enlarged in a direction parallel to that of *the cutaneous incision. D, introduction of talc. With the pericardium opened, the pericardial sac is aspirated* dry by means of a small rubber catheter. Moist gauge pads and packs are placed about the wound to protect exposed tissues from excess talc, and finger retractors are elevated to enlarge the operative area. The drawing illustrates the introduction of talcum powder, a specially constructed cannula being used to disseminate the powder in all directions around the myocardium. *E*, closure. The perichondrium and muscle and the connective tissues of the chest wall are closed in anatomic layers without drainage. The skin is approximated with silk.

the second or third day. It subsides gradually. The entire febrile course lasts less than ten days; rarely, it may persist as long as two weeks. The lungs and pleura are almost always involved. Fluid may form in the pleural cavity on the seventh to the tenth day in small amounts but rarely requires aspiration. Pulmonary consolidation of the left lower lobe begins after the first postoperative day. Pathologically, this is a form of interstitial pneumonitis, and there is no expectoration and no evidence of moisture in the alveoli. Striking bronchial breath sounds and a clear, high-pitched expiration may be heard best in the left axilla and below the angle of the left scapula. The patient does not appear ill and is not dyspneic or cyanotic. The mediastinitis, which makes its appearance from the first postoperative day, is demonstrable roentgenographically by bulging mediastinal outlines. The inflammation gradually resolves, but it may persist in mild form for several weeks. Although extensive adhesions form between the myocardium and the pericardium, the pericarditis is not of the constrictive variety and has never been known to constrict, distort or impede the heart. In fact, the adhesive granulomatous pericarditis established is a benign, beneficial and permanent sequela, which is directly responsible for the increase and maintenance of myocardial vascularity. A pericardial friction rub can be heard over the entire precordium, from the second to approximately the seventh day. Electrocardiographic changes characteristic of acute pericardial reaction appear within a few hours after the operation and persist for as long as several weeks. These changes include a downward shifting of the S-T segment of Lead III and a concordant shift in the R-S-T segment in the limb leads. Since none of these patients have normal electrocardiograms before the operation, the postoperative electrocardiogram can never be expected to return to a pattern closer to normal than its preoperative composition.

By far the most important of the complications that follow cardiopericardiopexy are those which arise because of the diseased state of the heart. Although extrasystoles may develop frequently during the operation, they are encountered only occasionally thereafter. Undoubtedly the most serious problem is coronary occlusion. The problem may take two forms. Despite every effort to prevent the patients from coming to operation with unrecognized but active infarction, 6 deaths in a total of 85 patients operated on were attributed to active infarction present but unrecognized at the time of the operation. Two of these patients died within forty-eight hours after the operation and 1 within a week, from rupture of an unhealed infarct. Several patients have had attacks of coronary occlusion subsequent to the operation, and 3 of these have died as a result of the process. Those patients who survived the operation for two months or more have weathered subsequent attacks of coronary occlusion, and only 1 of these died, a "sudden coronary death." Passive congestive heart failure occurring from one to seven years after the operation accounted for 6 deaths; nevertheless, it is a clinical impression that the operation prolonged the lives of these patients by delaying the onset of terminal congestive failure.

What are the benefits[9] derived from cardiopericardiopexy? Clinical improvement is statistically significant. In a fifteen-year study of patients who had undergone cardiopericardiopexy, 90 per cent were improved more than 50 per cent, and 40 per cent were improved more than 75 per cent, as shown by decrease in anginal pain, increase in exercise tolerance and improvement in ability to attend to their daily needs and return to a former or some other gainful occupation. In addition to this physical improvement, the patients who died after undergoing surgical treatment lived for an average five years, which gives them an average life span of nine and one-half years from the onset of the first symptom. This compares favorably with the average life span of four and one-half years (from the onset of the first symptom) of the patient treated medically for coronary disease. Statistically, cardiopericardiopexy contributed five years to the life of the average patient who underwent the operation.

These are advantages that cannot be contemptuously or presumptuously thrust aside.

### SUMMARY

The advantages and postoperative issues of cardiopericardiopexy as a method of surgical treatment for myocardial ischemia are recounted, and the operation is described and illustrated.

### SUMARIO

As vantagens da cardiopericardiopexia como método de tratamento cirúrgico da isquemia do miocárdio são relatadas, e a operação é descrita e ilustrada.

### RÉSUMÉ

Les avantages et les résultats postopératoires de la cardio-péricardiopexie en tant que méthode de traitement chirurgical de l'ischémie myocardique sont exposés; l'opération est décrite et illustrée.

### ZUSAMMENFASSUNG

Die Vorzüge und die postoperativen Probleme der Kardioperikardiopexie bei der chirurgischen Behandlung der Ischaemie des Herzmuskels werden erörtert. Die Arbeit enthält eine Beschreibung der Operation mit Illustrationen.

### RESUMEN

Se revisan las ventajas y resultados postoperatorios de la cardiopericardiopexia como método de tratamiento quirúrgico de la isquemia del miocardio describiéndose e ilustrándose la operación.

### RIASSUNTO

Vengono elencati i vantaggi ed i risultati della cardio-pericardiopessia nella cura dell'ischemia miocardica; viene pure descritto e illustrato l'intervento.

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We go to the gymnasium and the swimming-school to see the power and beauty of the body; there is the like pleasure and a higher benefit from witnessing intellectual feats of all kinds; as feats of memory, of mathematical combination, great power of abstraction, the transmutings of the imagination, even versatility and concentration—as these acts expose the invisible organs and members of the mind, which respond, member for member, to the parts of the body. For we thus enter a new gymnasium, and learn to choose men by their truest marks, taught, with Plato, "to choose those who can, without aid from the eyes or any other sense, proceed to truth and to being."

—*Emerson*

# The Evolution of Anesthesiology in Brain Surgery

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ANESTHESIOLOGY in brain surgery has labored under many difficulties, not only in the choice of narcosis-producing agents but in reanimation procedures. At first, general anesthesia alone was used. Toward 1910, local anesthesia, proposed by Cushing in the United States and by de Martel in France, became an asserted dogma. Nowadays, it seems, narcosis is coming to the front again. The tendency of preoperative, postoperative and operative anesthetic therapeutics has undergone notable variations, but has now taken advantage of important new discoveries resulting in equally important progress.

The first neurosurgeons relied on general anesthesia. Most of the volatile anesthetic agents were tried. Chloroform, first used by Horsley (1906), Hartley and Kenion (1907) and Krause (1910) was soon recognized as depressive and hypotensive (Kocher); its risks soon appeared as still greater than those encountered in general surgery; it was given up. Ether, less dangerous, was then adopted by most surgeons, although its main drawback, the tendency to bleeding, has been recognized (Horsley). Ethyl chloride then appeared to some, Cushing among them, as a good starter anesthetic.

The only prenarcotic then known was morphine (Bernard) used alone or in association with atropine, sparteine or scopolamine. It was first recommended by Horsley (1888) to precede the chloroform sleep, then by Kuttner and others; it was blamed for respiratory depression or for increased intracranial hypertension. Kocher (1899) and Krause (1910) warned against its systematic use.

The risks were considerably increased by the crude and unsafe conditions under which narcosis was obtained: compresses or masks were employed immediately next to the operative field, in the most unsuitable positions; the duration of narcosis was always excessive, and assistants were entirely under the control of the surgeon, who could give them only scant attention. On the whole, it was a dangerous practice.

This explains the favorable welcome that greeted the appearance of local anesthesia. The precursors of this new method were Heidenheim (1904), who injected epinephrinized cocaine under the galea, and Brun (1904), who inaugurated epinephrinized procaine hydrochloride. The real promoters prior to the 1914 war were de Martel and Cushing, who, dissatisfied with general anesthetics, adopted local anesthesia as a regular practice.

The advantages of local anesthesia cannot be doubted. It has none of the former drawbacks of narcosis, and remains devoid of toxicity whatever dose is required, since it causes loss of sensitivity only during the operative maneuvers known to be really painful, namely, those affecting the superficial organs. It enables the surgeon to maintain contact with the patient during the operation (except when loss of consciousness occurs) and thus to judge his condition easily.

Its drawbacks are no [illegible]; in the

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chief one is insufficiency. It insures painless incision of the scalp but does not induce tactile insensitivity, and the patient, should he be the least anxious or mentally confused, loses control of himself, moves his head and displaces the guiding marks. When it is time to close, the effect of the anesthesia has more or less vanished; the patient again suffers, and moves still more dangerously, just at the time when absolute calm is desired.

It cannot be positively stated that intracranial procedures are absolutely painless. Although the cerebral parenchyma has no sensitivity, certain structures in the head are susceptible to pain, such as the median meningeal artery (twitchings, especially at the hinge of the temporal flaps), the falx cerebir, the tentorium cerebelli, the meninges, the cranial basis vessels and the sensory cranial nerves (ninth and tenth). Besides, local anesthesia does not suppress the unpleasant perception of noises, vibrations and discomfort, and it leaves intact the subjective impressions of the patient; it submits him to an endurance test often beyond his strength, and its dangers as regards the vegetative system cannot be underestimated. Lastly, it does not prevent epileptic fits, vomiting and cough, nor does it insure free passage of air in case of obstructive or depressive accident.

Attempts have been made to palliate the shortcomings of local anesthesia by a preparatory potent basal anesthesia involving rectal chloral, intramuscular slow action barbiturates and more frequently opiates—morphine, total opium, heroin (Hunter). dihydro-morphinone, dihydro-oxycodeinone, pethidine, etc.—in association with classic vagolytics and correctors. Opiates, generally excellent in most cases, call for criticism: their depressive and cranial hypotensive effects had already been pointed out by several authors. Some considered chloral and the barbiturates preferable. Any basic anesthesia always offers the unassessable risk of being either excessive or insufficient. In this last case it may, paradoxically, increase the restlessness of the patient by abolition of his self-control. Often the association of basic anesthesia and local anesthesia fails; it is then necessary to renew the doses of the opiate under adverse circumstances, with the danger of overdosing and even of having to improvise, under the worst conditions, some type of general anesthesia, e.g., intravenous.

Notwithstanding justified criticisms, local anesthesia has established itself as a marked improvement over the older methods. It has uncontested services and has been contemporaneous of a great neurosurgical period; many neurosurgeons have remained its devotees.

An important event marks the present period. It is the coming to the front of physicians specializing in neurosurgical anesthesia. Their presence during the operation had for some time been usual in the United States, where their principal reason for being was to act eventually as reanimators, while in England they acted as anesthesists. It is only more recently that they have entered the picture in France, where they have been able to introduce and adapt new anesthetic and reanimating procedures especially suitable to surgical treatment of the brain.

*The Principles of Anesthesia.*—General anesthesia, though long supplanted by local anesthesia, never was completely abandoned, especially in England. But, to be absolutely justified, *it must satisfy four essential and imperative conditions:* 1. *It must not increase the intracranial arterial pressure.* 2. *It must not heighten the danger of hemorrhage.* 3. *It must not increase pain referable to the vegetative nervous system.* 4. *Its action must in no way interfere with the success of the operation.* To these four conditions must be added two practical necessities: *application must be remote from the operative field,* *and no explosive chemicals may be used.*

*a.* The influence of narcosis on the endocranial arterial pressure dominates the problem of anesthesia. It is known that cranial hypertension has general causes as well as the particular effect of neoformations or their complications. Among these causes are: hydrodynamic modifications of the status of the cerebrospinal fluid; secondary venous stasis due to increase of cerebral volume; perifocal edema, and active generalized edema due, according to J. Lebeau (1941), to irritation of the special vasomotor centers located in the brain stem. These factors may influence each other, independently of the neoformation, and are in themselves both sources and consequences of pain. They constitute a vicious circle. Aggravation of one of them, especially venous stasis (Guillaume and Jany, 1951), is capable of causing sudden decompensation of hypertensive states just barely tolerated until then. Yet, narcosis of itself creates a number of the aggravating disturbances it may introduce (Lazorthes and Campan, 1952). Any expiratory spasm (coughing, sneezing, vomiting, or expulsive efforts caused by an endotracheal probe or by tracheobronchial secretions or their aspiration); any expiratory trouble, and, in a general way, any intrathoracic suppression, either short or prolonged (controlled breathing under positive pressure), may cause venous hypertension, especially marked in the cerebral mass. A retrograde venous overload adds its effect to that of the already existing stasis, and a most dangerous increase in intracranial hypertension is created. Additionally, it has been demonstrated that phyoxy increases the cerebral volume through plasmatic exudation and that hypercapnea also increases it through capillary vasodilatation (White, Verlot, Silverstone and Beecher, 1942). As a consequence, it is clear that neurosurgical narcosis (1) *must create no increase of the positive intrathoracic pressure and no resistance to breathing, especially expiration;* (2) *must be antispasmodic, antiemetic and drying;* (3) *must allow strictly physiologic respiratory exchange, and* (4) *must preclude any postanesthetic agitation.* As a matter of fact, these exigencies are similar to those of any other surgical discipline, but in this connection they are most imperative. The preoperative increase of intracranial pressure, and, *a fortiori,* that of preexisting hypertension is dangerous for two reasons; it increases cerebral pain and creates turgescence with a tendency to evisceration, thus complicating and perhaps compromising the success of the operation. On perfect "cerebral relaxation" depends the "operative silence" necessary here as in any visceral operation.

*b.* The hemorrhagic danger is classic in surgical treatment of the brain. General anesthesia may increase it either through local vasodilation, through a general increase of arterial pressure or through the increase in venous tension just explained. Most of the causes that foster cerebral turgescence also foster operative or postoperative venous hemorrhage. After craniotomy the cerebral veins (nonmuscular) are more fragile than before, their internal pressure being no longer compensated by the cerebrospinal fluid pressure and the containment of the skull. The same situation results, in the closed skull, from cerebral collapse, a further reason why the narcosis must respect the exigencies aforedescribed.

*c.* General anesthesia may also increase the patient's vegetative pains in several ways: through intracranial hypertension, through hemorrhage and classic shock, through the toxicity of some anesthetics (liposoluble with cerebrospinal activity, depressors of breathing and of circulation). If it is not to become an additional aggression, neurosurgical narcosis must be purely *superficial, nonaggressive and atoxic for the brain.*

*d.* General anesthesia appears to be contraindicated only for those operations which have a functional objective, the effects of which must be immediately verified: procedures for the suppression of pain (anterolateral cordotomy), for dyskinesia (cordotomy, section-coagulation of the lenticular loop) and for epilepsy. Any strong premedication is to be prohibited.

*Anesthetic Technics.*—The various technical considerations just mentioned have only gradually become clear to anesthesiologists and neurosurgeons, and it has not always been possible to apply this sequence of logic with all the desirable rigidity. General and local anesthesia each have long retained their partisans. The problems discovered were but gradually solved.

Almost all the anesthesic products offered by the pharmacopoeia in the past fifty years have been tried one after the other, especially the noninhalatory type that permits application remote from the operative field. Their action on the intracranial pressure has been the subject of important studies (White, Verlot, Silverstone and Bercher, 1942; Woringer, Brogly and Schneider, 1951). A great many had to be rejected. *Ether* has the advantages of not being depressive of superficial regions and allowing normal respiratory exchange, but it presents the most severe neurosurgical drawbacks. It is a cerebral hypertensor and a venous hypertensor; it is cough-exciting, it is an emetic; it is hypersecretory; it is an explosive, a generator of postoperative excitation or depression, and is responsible for respiratory complications, themselves a secondary cause of anoxia and cough. It still has some advocates, especially in England, but its use today seems difficult to justify. *Ethyl chloride* might be permitted for short operations, but of all general anesthetics it is the most offensive intracranial and venous hypertensor and consequently must be eliminated. *Trichlorethylene*, introduced by Hewer (1941), may be retained, as it is nontoxic, indifferent as regards intracranial pressure, and nonexplosive; it also permits satisfactory exchange. Its use in open circuit, without sodic lime, is not a disadvantage. *Cyclopropane* should not be a cranial hypertensor below 50 per cent concentration, and consequently would not be such with the low concentrations required by the duration of the intracranial operation; its rapidity of induction and elimination is interesting. Its use is precluded only by its explosiveness. *Nitrogen protoxyde*, easily handled, atoxic, and nonreflexogenic, deserves a place in anesthesic cocktails. Its hypertensive effect at 80 per cent is easily corrected by any of the currently known hypotensive agents. It can, for the present, be considered the best maintenence anesthetic for the duration of an intracerebral operation (Hunter, 1947; Teplinsky, Zigmore, Cassels and Sugar, 1948).

Among rectal anesthetics, *ether*, proposed in 1929 by Frazer, has, of course, nothing more than historical interest, but *rectal chloral* is still frequently used for children; as regards *tribromethanol*, proposed by Dandy and by Sachs (1931), it has the advantage of being, in principle, indifferent as regards intracranial pressure; it may even be considered a cerebral hypotensor, in that it reduces the general arterial pressure; against this, it has the disadvantage of being depressive and of sometimes inducing an overprolonged sleep. The major argument against all rectal anesthetics is the erratic character of their action, varying from insufficiency to excess. Some authors have recommended the addition of avertine to the local anesthetic (Davidoff, 1934), to ether (Dandy, Dott) or to any other complemental product. All told, account being taken of its advantages and disadvantages, rectal anesthesia must be considered an interesting base anesthesia to be employed as required in the individual case.

*Barbiturates* have been tried from the onset. *Hedonal* was used and discarded by Mennel prior to 1914. *Nembutal* was used by Dott in 1933; *Pentothal* by Miller (1942), Ascrofft (1943), Woodhall and Goodmann (1943), and they considered it the ideal neurosurgical anesthetic. Yet the barbiturate was not at all ideal when these authors began using it; it is only later that it became so. Its major quality is an incontestable cerebrohypertensive action. This action is so irregular, however, that it would not have been sufficient justification for its use if the method of its administration had not been improved. Used alone and according to the early technics, it presented numerous neurosurgical drawbacks; it caused spasm and it depressed the respiratory exchange; the irregular and erratic character of the barbiturate sleep, the variations in the narcotic value, the difficulties of narcosis control, the risk of overdosage, the post-anesthesic agitation or depression. Its cerebrohypotensive action itself was dependent on unpredictable fluctuations in the anesthesia and of brutal inversions, for instance in case of coughing fits. In 1951, therefore, one could say that while pentothal fostered cerebral relations it also favored adverse secondary cerebral reactions. The results it procured could either be of the best or of the worst. Combining it with other anesthetics, such as protoxide (Hunter, 1947; Teplinsky and associates, 1948), only obviated some of its defects. A strong base anesthesia improves its efficacy but introduces drawbacks of its own.

That is why, in 1951, we adopted the *prenarcosis* recommended in France by Laborit and Huguenard for general surgery, and from which we obtained results difficult to overestimate. It covers, in fact, all neurosurgical requirements, allows correction of previous pentothal deficiencies, confirms and stabilizes the latter's hypotensive cerebral activity. It has thrown into oblivion the old basic narcosis induced by strong opiates. In our opinion, the acceptance of general anesthesia for surgical treatment of the brain is indisputably desirable.

The choice of the best anesthetic agents (barbiturate, nitrogen protoxide, trilene and lytics) is, however, not everything. The methods of administration are just as important. We have previously insisted on the value of the dilution of pentothal (easily handled, economical and nonhypotensive); on the use of diluted lytic cocktails in individual doses, with control of their hypnogenic and vegetative effects; on the advantages of *gradual loss of consciousness and awakening*, concerning which we agree with Hewer. The *limit positivity of the corneal reflex* for the whole duration of the operation is also an excellent and easily obtained evidence of safety. Local anesthesia of the scalp remains a very useful adjunct and best allows reduction of the doses of general anesthetics.

*Tracheal intubation*, an elementary requirement of narcosis remote from the operative field, had the advantages of excluding the obstruction accidents by which cranial operations were previously impaired; of facilitating artificial breathing in case of depressive accidents, and always of maintaining physiologic respiratory exchanges. Of course, it must also satisfy the general requirements previously explained. *Intubation and extubation must be achieved in a strictly nonreflexive manner, toleration of the probe must remain absolute throughout the duration of the operation, notwithstanding the mildness of the narcosis.* Rapid intubation assisted by pentothal-curare must be rejected, as it suppresses all reflex reaction, requires apneizing doses calling for immediate controlled respiration manipulations (undesirable, as we shall show) and contributes nothing toward ulterior toleration of the probe. is int tion an equal degree of hypotension, when the patient is in a recumbent position. If it is admitted with Bernsmeier and Siemons that intracranial hypertension itself mechanically lowers the cerebral output, then a consequent reduction of the margin of safety must be admitted. It is prudent, then, as recommended by Petit-Dutaillis and Guiot, not to begin or to reduce the hypotension further until after the flap has been opened. According to Aserman, the pressure from the retractors would be more ischemic for the vasoplegic patient (compression anemia) and might create irreversible local anoxic lesions. Inversely, hibernation would increase the resistance to ischemia through reduction of the oxygen need of the nervous tissue.

Finally, emphasis must be put on the advantages as well as the drawbacks of a series of methods that find in neurosurgery their best indications as well as their greatest dangers. We ourselves use these methods daily with precise technics, taking maximum heed of the individual factors within strict safety limits, their efficiency against turgescence and blood effusion is sufficient. It would be excessive to strive for absolute exsanguination. The ganglioplegics participate in the treatment of the postoperative cranial hypotension.

*Reanimation.*—When Cushing insisted, for the first time, on close observation of the postoperative fluctuations of the vegetative status of the patient, he laid the first stone of neurosurgical reanimation. In this realm, as in the others, theories have greatly progressed, and reanimation, having more and more become a prophylactic question, really deserves a change of its name. It is essential to prevent disorders before their installation, when they have not yet formed a vicious circle from which their elimination could only be more or less incomplete, and might even be prejudicial to the balance of the organism.

For a long time, efforts were concentrated on correction of collapse and/or shock mainly due to the operative hemorrhage, then frequent, the consequences of which were aggravated by the ischemia characteristic of cerebral hypertension (Bernsmeir and Siemons) as well as by the lesser resistance to aggressions of patients with central lesions (Mosinger's neurogen heterergia). Postoperative transfusion has brought elimination of hemorrhagic shock in neurosurgery, as in other operative fields. There is very little to say on that subject: massive, and sometimes even abusive, originally perfusions now are much more rational; they have become, in many cases, superfluous since the advent of the hypotensive and hibernation methods procuring prophylaxis of shock as well as its tolerance by vasomotor regulation.

Besides hemorrhage and shock, the neurosurgical patient is known to present particular vegetative disorders associated with intracranial neoformation and following the operation. The acute clinical picture of the central neurogenous syndrome is of varying intensity but sometimes dramatic. Troubles of conscience, especially vegetative (Vincent) of the thermic, tensional, cardiac, respiratory, metabolic and endocrinous regulations are encountered. The prognosis often is of the darkest. The pathogenesis simmers down to a Reilly syndrome of central origin, as serious as possible. Mosinger and G. Tardieu have both reproduced it in animals by direct traumatism of the vegetative nucleus or by intradiencephalic and peduncular injections of irritative substances. For G. and C. Tardieu the operative sequelae of these experiments have the same value as actual experimentation on human beings. There are numerous causes for vegetative irritation during the evolution of a neurosurgical illness. Prior to the operation, the neoformation has no direct influence unless it is located in the immediate vicinity of the centers, but it has an indirect influence, mostly through the intracranial hypertension it causes. During the operation more or less serious vegetative disorders may be observed: loss of consciousness when local anesthesia in used, sudden fall of the arterial pressure, or, on the contrary, a sudden hypertensive outburst, often concomitant with an outburst of cerebral edema, polypnea, stertor or respiratory syncope (juxtabulbar tumors), etc. The cerebral parenchyma, besides, is the most sensitive of all to surgical traumatism; its vasomotor reactions are the most immediate, the most intense and the slowest to subside. Operative acute cerebral edema takes place as suddenly as does Quincke's edema. The prognosis of postoperative sequelae is dominated by the possibility of cerebral hypertensive complications (edema, blocking by cerebrospinal fluid, secondary hemorrhage) as well as of hypotensive disorders, the danger of which is increased in the presence of controlled hypotension. The risk of vegetative irritation is of course much greater in axial or para-axial operations (diencephalic and posterior fossa) than in operations involving the convexity.

Treatment of such a syndrome has always been most difficult. In attempting to restore vegetative balance, surgeons formerly had recourse to the complete range of the mimetics and lytics then known, a slight preference being given to the former. The same errors as in the other domains were committed with the same good intentions, even to the extent of recommending intravenous epinephrine for vascular collapsus of diencephalic origin. All these empiric, symptomatic therapeutic methods were generally deceptive.

Because of the peculiar clinical picture, which gives an impression of forcing, and considering its pathogenesis, we thought in 1951 that hibernation therapy following the procedure established in France by Laborit (sleep, vegetative blocking, refrigeration) could bring the answer to our problems, not only as regards the vegetative symptoms but also in tracing their causes: stasis and cerebral edema. Its efficacy has, since then, been amply proved.

The central action of its pharmacodynamic agents is highly favorable; it prevents or reduces dangerous hyperthermy, agitation and respiratory burden, and regularizes the oxymetry of cases in which cyanosis is present. It is at so deep a level that it is really active against tachycardia. Its indications may seem questionable with regard to disturbances of consciousness; it seems illogical to treat coma by sleep, and on this point the therapist must do himself violence, even if he agrees with G. Tardieu on the irritative pathogenesis of these disturbances. Its antiemetizing and anticonvulsive actions are valuable. Its action on cerebral edema diminishes the severity of the attack.

It is possible today to affirm its many and significant indications. Preoperative hibernation therapy is capable of improving serious acute neurovegetative syndromes such as would, without this therapy, be considered as contraindicating operation on the grounds of excessive danger. It makes it possible to proceed quietly and without danger in the localizing examinations. Its major indications are procedures affecting the diencephalic region (tumors of the third ventricle, craniopharyngiomas, median, olfactive and sellar meningiomea) or the posterior fossa, especially the tumors of the fourth ventricle, which Mahoudeau has well studied. It is equally indicated for all extensive exereses of gliomas and meningiomas likely to react indirectly on the walls of the third ventricle. In cases of cranial traumatism, we have detailed elsewhere its indications and limitations.

It is mostly as a preventive that it must be used. Its preoperative induction is easily obtained, since the prelytic narcosis also is a prehibernation. [illegible] require underlining. The drug dosage is individual and cannot be determined otherwise than extemporaneously, by control of the sleep threshold and the degree of vegetative disconnection. It may be expedient to dissociate the components of the "cocktails." Refrigeration must not begin until a sufficient sleep and pharmacodynamic blocking have been obtained, else it might be inoperative and even aggressive: loss of the hypothermic advantage, increase in the oxygen consumption after it has been reduced by the action of the drugs. A well-started hibernation presents no further maintenance difficulties. The efficacious hibernation level varies from one patient to another. If simple pharmacodynamic hibernation is generally sufficient, there are cases in which deep hibernation proves absolutely necessary. Hypothermy below 34 C. (and as low as 30 C.) seems to be possessed of a lytic action of its own, which pharmacodynamic neurolysis cannot, of itself, procure. Georges and Cahn have defined "cortical temperature" as the temperature observed when extinction of pituitary reactivity has been obtained. When deep hypothermy has been obtained for twelve or twenty-four hours, its maintenance becomes easier and easier, with reduced amounts of drugs and refrigeration, and tends to become spontaneous. Suppression of the hypnogenics makes it possible to obtain wakeful hibernation; the patient, at 32 C. for instance, regains consciousness, swallows normally and does not complain of cold.

Some special cases must be noted. Resistance to hibernation is observed in neurosurgical patients as it is in other fields. Hypersensitivity to hibernation is a special characteristic of neurosurgical diseases. We have observed it in a case of exeresis of a myxedematous craniopharyngioma, after a clipping of the anterior cerebral for juxtaclinoidal aneurysms, and in several cases of cranial trauma followed by death (probably destructive diencephalic lesions). In all such cases, diencephalopituitary deficiency seemed to be the cause.

Indications for hibernation and hibernotherapy are exclusively limited to the acute neurovegetative syndrome. More and more frequently we observe a subacute or chronic vegetative syndrome whose evolution covers several weeks or several months, with characteristic increasing psychic indifference, anorexia of malnutrition, eschars, and finally cachexia with deep hydromineral disorders. Its frequency may be increased by hibernation in patients who would initially have succumbed and who nevertheless do not resist it. We wonder whether hibernation would not have fostered this subacute or chronic syndrome in cases in which destructive diencephalopituitary lesions are added to the initial irritative process. Any function-retarding therapy can then be aggravating. This syndrome should be the object of a stimulating therapy, perhaps of an endocrine nature.

## CONCLUSIONS

Starting from sleep-producing formulas so inadequate that local anesthesia was long found to be at least preferable, neurosurgical narcosis had to be gradually adapted to the requirements set by the extreme sensitivity of a diseased and hypertensive brain. Hazardous in its early stages, narcosis has been freed of any dangerous consequences by a judicious selection of anesthetic and preanesthetic agents and by patient technical improvement in the methods as well as in the drugs used. Essential progress has been achieved since 1951, when vegetative prenarcosis and lysis of the vegetative nervous system (Laborit and Huguenot) and controlled hypotension (Guiot and Damoiseau) made possible a therapeutic approach that increased simultaneously the operability of the brain and its tolerance of the procedure. Cerebral surgery has therefore been one of the principal beneficiaries of hibernotherapy according to the method described by Laborit, a therapy constituting a remarkable treatment of the acute central neurovegetative syndrome.

If the purely anesthetic problems have, as a whole, received satisfactory solutions, the problems of so-called reanimation have not yet reached quite the same stage. The operative limits have been broadened, and survival of the diseased or of the most severely traumatized patients now is almost always assured. But survivors with conditions that were formerly fatal have revealed pathologic conditions still uncleared, such as, in some cases, postoperative diencephalitis of long duration, finally ending in death. The secondary complications reveal new problems and suggest new research.

## SCHLUSSFOLGERUNGEN

Seit den Tagen der Verwendung von Schlafmitteln, die so unzulänglich waren, dass die Lokalbetäubung bald den Vorzug gewann, musste sich die Narkose in der Chirurgie des Zentralnervensystems allmählich den besonderen Erfordernissen anpassen, die ein so empfindliches Organ wie ein erkranktes Gehirn zu stellen hat. Die Narkose, die anfänglich noch ihr Risiko hatte, ist jetzt durch eine urteilskräftige Auswahl der vor und zur Anästhesie angewandten Mittel und durch geduldige Verbesserung der Technik und der Mittel ihrer Gefahren beraubt worden. Wesentliche Fortschritte sind seit 1951 zu verzeichnen. Die vegetative Pränarkose und die Lysis des autonomen Nervensystems (Laborit und Huguenot) sowie die kontrollierte Hypertension (Guiot und Damoiseau) eröffneten einen Behandlungsweg, der gleichzeitig die Operabilität des Gehirns und die Verträglichkeit des Eingriffs verbesserte. Die Gehirnchirurgie gehört zu den Gebieten, die den grössten Nutzen aus der Hibernotherapie nach dem von Laborit beschriebenen Verfahren gezogen haben, einer Behandlung, die eine bemerkenswerte Massnahme bei akuten zentralen neurovegetativen Erscheinungen darstellt. Während die Probleme der reinen Anästhesie im ganzen zufriedenstellend gelöst worden sind, haben die Schwierigkeiten der sogenannten Reanimation noch nicht im selben Masse beseitigt werden können. Die operativen Möglichkeiten sind erweitert worden, und das Ueberleben der Erkrankten und selbst schwer verletzter Patienten ist heutzutage fast immer sichergestellt. Aber die Ueberlebenden aus der Gruppe, die in früheren Zeiten tödlich ausgegangen wären, entwickeln Krankheitserscheinungen, die bis heute ungeklärt sind, wie z.B. die postoperative Dienzephalitis, die lange anhält und schlieaslich tödlich endet. Die sekundären Komplikationen stellen neue Probleme dar und erfordern neue Forschungsarbeit.

## RÉSUMÉ

Les méthodes d'anesthésie pour la neurochirurgie étaient si inefficaces que pendant longtemps on préféra recourir à l'anesthésie locale. La narcose en neurochirurgie a dû être adaptée graduellement aux exigences de l'extrême sensibilité d'un cerveau malade et hypertendu. La narcose —qui à ses débuts constituait un grand risque—est devenue sans danger par suite du choix judicieux des narcotiques, et d'un patient travail d'amélioration des techniques. C'est depuis 1951 que les progrès les plus grands ont été faits dans ce domaine, avec la prénarcose végétative et les médicaments à action lytique du système neuro-végétatif (Laborit et Huguenard). En contrôlant l'hypertension (Guiot et Damoiseau) on crée une technique augmentant à la fois l'operabilité du cerveau et sa tolérance. C'est pourquoi la chirurgie cérébrale a été une des principales bénéficiaires de l'hibernation suivant la méthode décrite par Laborit; cette thérapeutique constitue un traitement remarquable des syndromes aigus du système central neuro-végétatif.

Dans leur ensemble, les problèmes relevant purement de l'anesthésie, ont trouvé des solutions satisfaisantes, mais on ne peut en dire autant encore de la réanimation. Les limites de l'opérabilité ont été élargies, la survie des malades ou des grands traumatisés est maintenant presqe assurée. Mais les malades qui survivent dans ces cas présentent des symptômes encore inexpliqués, telle, quelquefois, la diencéphalite chronique dont l'issue est fatale. Les complications secondaires ouvrent la voie à de nouveax problèmes et à de nouvelles recherches.

### CONCLUSIONES

A partir de fórmulas hipnóticas tan inadecuadas para anestesia local se encontró que al menos eran preferibles, la narcosis neuroquirúrgica ha tenido que ser adaptada gradualmente a los requerimientos establecidos por la extrema sensibilidad de un cerebro enfermo e hipertenso. Con riesgos en sus primeros estadíos, la narcosis ha sido liberada de cualquier consecuencia peligrosa por la selección juiciosa de los agentes anestésicos y preanestésicos y por el mejoramiento técnico en los métodos así como en las drogas. Se realizaron progresos esenciales desde 1951, cuando la prenarcosis vegetativa y lisis dl sistema nervioso vegetativo (Laborit y Huguenot) así como la hipertensión controlada (Guiot y Damoiseau), hicieron posible un abordaje terapéutico que aumentó simultáneamente la operabilidad del cerebro y su tolerancia al procedimiento. Por lo tanto la cirugía cerebral ha sido uno de los principales beneficiados por la hibernoterapia de acuerdo con el método descrito por Laborit, constituyendo un tratamiento notable del síndrome agudo neurovegetativo central.

Si los problemas anestésicos como un todo han recibido una solución satisfactoria, los problemas de la llamada reanimación no han sido solucionados en el mismo grado. Los límites operatorios se han ampliado y la supervivencia de los pacientes enfermos ó traumatizados gravemente es casi siempre segura. Pere los supervivientes en casos de naturaleza anteriormente fatal han revelado condiciones patológicas todavía no esclarecidas tales como diencefalitis postoperatoria de larga duración y término fatal. Las complicaciones secundarias revelan nuevos problemas y sugieren nuevas investigaciones.

### CONCLUSIONI

Dal tempo in cui si cominciarono a usare farmaci ad azione ipnotica, cosí inadatti da essere di gran lunga inferiori all'anestesia locale, la narcosi si è venuta gradualmente adattando alla nuove necessitá delle neurochirurgia. Rischiosa all'inizio, la narcosi è stata gradualmente liberata da ogni dannosa conseguenza mediante un'opportuna scelta degli anestetici e dei preanestetici e per merito dei progressi tecnici.

I maggiori progressi sono stati fatti nel 1951, quando la prenarcosi vegetativa e il blocco del sistema nervoso vegetativo (Laborit e Huguenot) e l'ipotensione controllata (Guiot e Damoiseau) hanno aumentato le possibilità di intervento e le resistenze del cervello. La neurochirurgia è il campo principale dell'ibernazione, che è il metodo di cura delle sindromi acute centrali neurovegetative.

Se tuttavia i problemi puramente anestetici sono stati soddisfacentemente risolti, non altrettanto si può dire della cosidetta rianimazione. I limiti operatori sono stati allargati ed e possibile assicurare la sopravvivenza dei malati, ma coloro che sopravvivono ad affezioni un tempo fatali vanno incontro a quadri morbosi ancora oscuri, quali la diencefalite post-operatoria di lunga durata e di prognosi infausta. Queste complicazioni secondarie aprono nuovi problemi e impongono nuove ricerche.

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# Hürthle Cell Tumors of the Thyroid Gland

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IS it preferable to discontinue the use of the terms "Hürthle cells" and "Hürthle cell tumors of the thyroid gland"? There seems to be ample justification and popularity to justify continued use of these terms. The cells, as observed in Hürthle cell tumors and the Hürthle cell reaction, if we may so term it, present a definite and striking microscopic picture with varied cytologic manifestations. These cells may be present in many types of goiter; they play a significant or paramount role in many adenomas and, probably less commonly, in carcinomas of the thyroid gland. Our purpose is to review the entire problem of Hürthle cells as observed in the thyroid, which have been a "barbedwire obstacle" in the literature on the thyroid gland.

*Historical Review.*—Hürthle,[1] a German physiologist, was one of the first to describe the striking, large acidophilic cells of the thyroid gland in 1894. He postulated that these large acidophilic cells had their origin from a special interfollicular (parafollicular) type of thyroid cell. The existence of such a special type of thyroid cell has been doubted by more recent investigators.[2] Baber[3] had reported previously on a similar type of cell in man as early as 1876 and 1881.

Askanazy,[4] in 1898, described these large, acidophilic cells as occurring in the thyroids of patients with thyrotoxicosis. Since then, many have called attention to similar observations in thyroids removed from patients with this disease.[5]

Langhans,[6] in 1907, referred to the distinctive cytologic pattern and characteristics of these tumors by stating that "one glance through the microscope suffices to establish the diagnosis." He described what he thought to be a specific type of thyroid tumor in which the component cells were large, oxyphilic and arranged in alveoli or trabeculae.

Getzowa[7] termed these tumors "struma postbranchialis" and maintained that these types of neoplasm had their origin from the ultimobranchial bodies. It may, in our opinion, be fairly stated that this view as to their origin is no longer tenable.

Broders,[5b] in 1929, published a paper entitled "Regenerative Hyperplasia in Exophthalmic Goiter: A Condition Simulating Carcinoma." The microscopic or cytologic characteristics of the cells described in this paper seem quite similar to those associated with the conditions here to be described. Clute and Warren[8] also noted the similarity between these oxyphilic tumor cells and the involutionary changes associated with thyroid hyperplasia.

Wegelin[2d] and others[9] have expressed the opinion that the large oxyphilic cells in tumors of this type do not represent a separate anatomic type of cellular entity but rather a functional unit or change. Wilensky and Kauffman[5m] seem to share this opinion with regard to the significance of this type of cell.

A powerful stimulus discussion of Hürthle cell tumors in the literature on thyroid disease, at least in America, was supplied

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by Ewing.[10] He offered an excellent description of the structure of these Hürthle cell tumors, and on page 524 of his text one finds the Hürthle cell tumor depicted in an illustration.

The term "onkocyte" was introduced by Hamperl.[11] Apparently these cells may be easily demonstrated by means of special inclusion stains.[12] This type of cell is supposed to represent a degenerative transformation of parenchymal cells of the thyroid, but it may also exist in the parathyroid, adrenal, salivary and pituitary glands. Hamperl[11] has mentioned two other cell types observed in the thyroid, i.e., the colloid cells of Langendorff and the interfollicular (parafollicular) cells of Hürthle. This communication has thus caused no small degree of confusion. What Willis[9b] has said about the interfollicular cell may also be said about the "onkocyte." Eisenberg and Wallerstein[5e] reported that the probable source of the Hürthle cell tumor is parathyroid tissue. They maintained that the Hürthle cell is similar to the pale, oxyphilic parathyroid cell of Welsh. Similar confusion has been introduced by identification of these cells with similar ones. Regardless of the source of origin,[13] these large, acidophilic cells, as they occur in various types of goiters, present a striking microscopic appearance, and in our opinion, for want of a better designation they should continue to be called Hürthle cells.

Willis[9b] stated that the term "Hürthle cell tumor" as currently used is "trebly unfortunate (1) because there is no real evidence that the tumors are related to the cells described by Hürthle, (2) because the very existence of special interfollicular cells in the thyroid is doubtful, and (3) because even if special cells of this kind exist and the tumors arise from them, the eponymic name is inappropriate, since Baber[3] described the same cells seventeen years before Hürthle." Willis[9b] suggested the term "eosinophilic large-celled tumor of the thyroid." Regardless of the origin of these cells, which probably represent a structural variant of ordinary thyroid epithelium, we concur with Chesky, Dresse and Hellwig[5c] that the name Hürthle cell tumor is too well established for its use to be discontinued.

Wegelin's viewpoint[2c] and that of Wilensky and Kauffman,[2d] that the Hürthle cell is a physiopathologic rather than an anatomic variant of thyroid cells, has been given additional impetus by Friedman.[14] Friedman has pointed out that the development of Hürthle cells takes place not only in cases of thyroid hyperplasia, Hashimoto's disease or exhaustion atrophy but as a consequence of irradiation, the administration of thiouracil and partial or subtotal thyroidectomy. Certain epithelial alterations, the most prominent of which is the formation of Hürthle cells, he referred to under the designation "cellular involution."

The confusion in the literature on the pathologic character of thyroid tumor, so far as Hürthle cell tumors[15] are concerned, seems to us unwarranted. Nearly all of the aforementioned communications seem to be describing a similar type of cell and tumors with an identical or very similar cytologic picture.

*Definition of Hürthle Cell Tumor and the Hürthle Cell Reaction.*—This is a striking, specific and very definite type of cellular reaction or change occurring in the thyroid gland, with many variable microscopic features. The cells are of the large acidophilic type (or oxyphilic, as they have also been called). They are often large, sometimes of giant size; finely granular, eosinophilic, opaque and sometimes clear. These cells may be cuboidal, cylindric or irregularly polyhedral. Pleomorphism is often present and may be present to an extreme degree. The nuclei may be small or large; they are vesicular, [illegible] with visible and prominent nucleoli and often markedly hyperchromatic.

Microscopically, the cells may be arranged in almost any type of grouping—trabecular, alveolar, follicular or papillary.[16] For this reason, it is difficult to consider them a subfollicular group or to assign them to any other single similar subgrouping or classification as regards arrangement.

There seems little reason for the pronounced confusion in the literature concerning such a characteristic, striking microscopic appearance as is characteristic of this type of tumor. Certainly the proper names of Getzowa, Askanazy, Langhans, Langendorff, Baber, etc., need not add to the confusion. We refer simply to the ürthle cell as the large type of acidophilic ell with multiple types of grouping or microscopic arrangements or even without any specific grouping, as observed in many types of goiter. The same cells may occur in adenoma or, more rarely, in carcinoma of the thyroid, as a small or insignificant part, but these cells may also be the major or predominant type of cell found in such cases.[17]

When Hürthle cells exist to an insignificant extent in nontumorous thyroids or glands with thyrotoxicosis, etc., we suggest the term "Hürthle cell reaction." This cytologic picture may, of course, be but one of the manifold cellular variations observed in adenomas or carcinomas of the thyroid gland.[9a] The Hürthle type of cell may comprise the predominant or larger portion of a particular tumor or mass in the thyroid, or it may be only a very small part of the total picture. If this type of cell predominates or represents the major portion of a tumor, we are of the opinion that the growth should be termed Hürthle cell tumor, i.e., benign or malignant Hürthle cell tumor.

In more recent years, some have urged that the malignant nature of these tumors be emphasized. Indeed, the tumor is now considered malignant by those who would subscribe to the most recent edition of the "Manual of Tumor Nomenclature" prepared by the American Cancer Society in 1951.[18] In the latter, the designations "Hürthle cell adenoma" and "Hürthle cell tumor" have been abandoned, but the designations "Hürthle cell adenocarcinoma" and "Hürthle cell carcinoma" are recommended. One cannot deny that these large, eosinophilic cells (Hürthle cells) do occur in many types of goiter and that these same cells may predominate in certain adenomas of the thyroid. Categorical designation of all Hürthle cell adenomas as malignant seems reprehensible, in spite of the fact that the true carcinomas or Hürthle cell adenocarcinomas may behave clinically as if they were benign. These cells, microscopically, may often simulate malignant features. However, there does seem to be a justifiable place and reason for the continued use of "Hürthle cell adenoma" and, if you will, the "Hürthle cell reaction," as well as the true Hürthle cell carcinoma or the Hürthle cell adenocarcinoma of the thyroid. A place for the benign form of the Hürthle cell in tumors of the thyroid is amply recognized by the authoritative publications of Warren and Meissner in "Tumors of the Thyroid Gland," published by the Armed Forces Institute of Pathology,[17b] and the "Standard Nomenclature of Diseases and Operations."[19]

## REPORT OF ILLUSTRATIVE CASES

Case 1.—The patient, P. S., lost 20 pounds (9.1 Kg.) in weight within three months, associated with palpitation, nervousness, excessive fatigue, excessive appetite and intolerance to heat; perspired freely, and complained of weakness in the quadraceps muscles. Three preoperative basal metabolism tests were done; the results were plus 55, plus 57 and plus 71. Examination disclosed the thyroid to be firm and the right lobe enlarged. The diagnosis was toxic nodular goiter. Preoperatively the patient was given propylthiouracil, followed by Lugol's solution. Subtotal thyroidectomy was performed on March 5, 1948, after which irradiation was administered over the thyroid isthmus.

The original pathologic report was made elsewhere, and the pathologist's diagnosis was Hürthle cell adenocarcinoma of the thyroid gland. The following pathologic report was made on March 5 from a study of only the adenomatous portion of the excised tissue:

"The microsections show an encapsulated thyroid adenoma of a mixed, predominantly microfollicular type, void of hyperthyroid reaction and surrounded by a thick, compact fibrous capsule. The acinar of type cell is cuboidal, with pale, granular, almost hydropic pink-grey cytoplasm. Scattered irregularly throughout the adenoma are acini and clumps of cells composed of characteristic large, pink-staining cells of the Hürthle type. These cells show moderate pleomorphism, definite nuclear hyperchromia and pyknosis but no mitotic figures. There were six noteworthy features: 1. A number of acini were lined *only in part* with Hürthle-type cells, the other cells conforming in size, staining, form and arrangement with the usual thyroid acinar epithelium (this would suggest a single identical cell origin of the two types of cells). 2. In involved acini containing Hürthle cells, the latter occasionally showed hyperplastic, multilayered cell clumps. 3. Where identifiable, Hürthle cell acini always contained colloid. 4. No mitotic figures were observed, regardless of the degree of pleomorphism, nuclear daub, giant forms and cell disorganization. 5. Disorganized clumps of Hürthle cells could be seen, void of acinar arrangement and usually intermixed with simple follicular and "Hürthle acinar forms; this was not accompanied by any stromal fibrous tissue proliferation. 6. There was consistent confinement of the Hürthle cells, with refusal to bridge, invade or cross the fibrous capsule. The presence of Hürthle cells outside the capsule would have been an influencing factor in interpretation of the neoplasia but would not have been accepted as a positive index of malignancy. The tumor was originally diagnosed as a Hürthle cell carcinoma. In the light of considerable experience with this type of tumor and the subsequent postoperative interval of excellent health (six years), this tumor is now considered a Hürthle cell formation in a simple follicular thyroid adenoma unrelated to the surrounding hyperplastic t oid tissue.

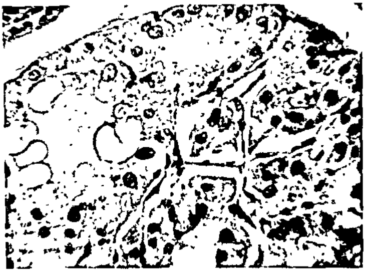

Fig. 1. (E. K., Case 2).—Hürthle cell reaction in diffuse toxic goiter. Note well-defined acini and nonacinar clumps of Hürthle cell epithelium, with clearly defined fibrous tissue septums supporting individual acini and clumps. There is slight nuclear pleomorphism with occasional pyknosis. The lobule periphery is sharply defined, without bridging. Note the multilayering in the lower central acinus; colloid in acinus.* × 440.

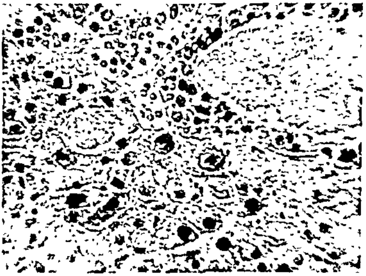

Fig. 2. (P. S., Case 1).—Hürthle cell reaction in simple follicular thyroid adenoma. Two follicles in upper right border, with acinus on right border showing typical simple small cuboidal epithelium on the left side, assuming eosinophilia and enlargement to Hürthle form on the upper and lower borders of the acinus identical with lower central disorganized clump of Hürthle cells in the general field. In center, note small Hürthle acinus and two large, vesicular nuclei in Hurthle cells. Remainder of nuclei tend to be pyknotic, a characteristic of degeneration and involution. × 440.

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as we know the importance of not interpreting the presence of cells of this type in the thyroid as synonymous with thyroid cancer. We wish to emphasize this point strongly.

Friedman[20] interpreted this cellular reaction as a type of cellular involution. He observed it in goiters associated with myxedema or thyrotoxicosis; glands previously treated with antithyroid drugs, (thiouracil, etc.); glands previously treated by irradiation, residual thyroid glandular tissue after subtotal removal of the thyroid gland. All of this seems to lend support to the theory of some type of functional change in the thyroid cells rather than to the occurrence of a certain anatomic cell in the thyroid (Wilensky and Kauffman.)[2d] We concur in this opinion.

There seems little doubt, however, that Hürthle cells have a definite neoplastic counterpart in no small number of goiters. They may make up the whole, or only part, of the microscopic and gross pathologic picture in cases of thyroid adenoma, whether benign or malignant. Less commonly they form a part of, or are predominantly or solely, the type of cell seen in some thyroid carcinomas.

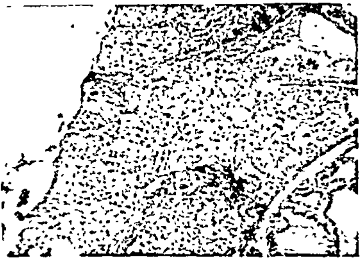

Fig. 5. (C. K., Case 2).—Hürthle cell reaction in toxic diffuse goiter. Note Hürthle cells, usually in clumps without acinar formation, [illegible] ing of inter-lobular space, no extension beyond orderly border of lobule. Non-Hürthle acini along right border. × 100.

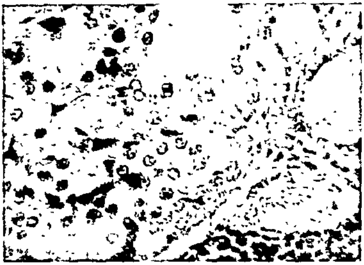

Fig. 6. (E. K., Case 2).—Hürthle cell reaction in toxic diffuse goiter. Note Hürthle cells in acini and in nonacinar clumps, adjacent to large capillary sinus and field of lymphocytes. Note uniformity of nuclei, colloid in acini, and delicate fibrous septums between smaller cell clump units. × 440.

*Benign vs. Malignant Hürthle Cell Tumors.*—All surgeons know the fallacy of relying entirely on microscopic criteria for distinguishing benign from malignant tumors in the thyroid gland. Hürthle cell tumors are no exception to this rule and are another element in a continually perplexing problem. It is with those tumors which often have extreme cellular pleomorphism that one needs to bring into play all the criteria of malignancy on microscopic examination, i.e., capsular invasion, vessel invasion, lymphatic invasion or gross or microscopic nodal metastasis. Elastic tissue stains such as those of Verhoeff or Weigert may help to identify blood vessel walls when there is vascular invasion as described by Warren and Meissner.[17b] Conceivably, there may be metastasis from carcinoma of the thyroid without either capsular invasion or vessel invasion but such cases must be uncommon. The term "benign metastasizing goiter" has caused considerable confusion; it should be discarded. It may [illegible] hat only a [illegible] years of careful fo [illegible] n the [illegible] of some of these [illegible] mad

bers. In such cases the condition may be actually a simple Hürthle cell reaction or a Hürthle cell adenoma. The tumor may not be malignant and should not be considered malignant without histologic or clinical justification. Broders[5b] emphasized this point adequately many years ago.

It would seem difficult to classify these tumors as purely follicular, trabecular, papillary or alveolar, as suggested by Chesky, Dreese and Hellwig[5c] and Goldenberg[12] because admixtures of all these types occur rather frequently. The cellular pattern varies considerably at times, even in the same goiter.

We suggest that the terms "onkocyte" of Hamperl,[26] metastasizing goiter,[27] colloid cells of Langendorff[20] and parafollicular or interfollicular[28] designations be discontinued. Continued association of additional proper names, such as Getzowa,[7] Langhans,[6] Askanazy,[4] and Baber[3] with tumors of the type here described, serve only to confuse.[15a] As has been suggested, the large, eosinophilic cells occurring in various types of goiter, regardless of their cause, should be designated by the terms Hürthle cells, Hürthle cell reaction, Hürthle cell adenoma or Hürthle cell carcinoma or onkocarinoma, according to the situation of a given condition in the thyroid.

Why is the survival rate so high in some of the reported series of Hürthle cell carcinomas? Does this type of carcinoma offer a much better prognosis than other types of carcinoma of the thyroid, even the papillary type? The five-year survival rates for all types of thyroid carcinoma, as reported by numerous observers in the medical literature,[29] has ranged from 7.8 per cent to as high as 61 per cent (Pemberton).[30] The clinical course of many Hürthle cell cancers has been prolonged, the disease remaining localized in the neck for many years in some cases.[22a] Chesky and his associates[5c] stated that 88 per cent of their patients were alive one and one-half to nine years after surgical intervention and that 80 per cent of the total number were free of disease after local surgical treatment in 96 per cent of the group. Goldenberg,[12] reporting 22 cases of Hürthle cell carcinoma, noted a very high rate of survival, at least 68 per cent, after less radical operations in most of the cases.

In our opinion this unusually high survival rate for Hürthle cell neoplasms designated as malignant is due not to a low grade of malignancy but to the pathologist's improper designation of some of these tumors as malignant. This would appear to be confirmed by the figures of Frazell and Foote,[31] whose end results with Hürthle cell cancers were not nearly so favorable with only one-third of the patients falling into the five-year follow-up series and being alive and free of disease during this period. These authors[31] concluded that a more radical approach to the treatment of these carcinomas of the thyroid is indicated.

Careful study of these tumors for evidence of malignancy seems indicated, particularly because of their microscopic characteristics. In the absence of vessel or capsular invasion the diagnosis of Hürthle cell carcinoma is indeed difficult, and it is rendered more so by the frequently extreme pleomorphism of the cells.

## SUMMARY

*The terms "Hürthle cell reaction" and "benign and malignant Hürthle cell tumors" should be continued as a distinct and separate entity in the pathologic field with regard to thyroid tumor. The large eosinophilic Hürthle cells present a distinct, striking and characteristic appearance in the thyroid gland. It seems difficult to classify or subgroup tumors made up of these cells be[illegible] of the cellular a[illegible] which may be [illegible]*

The term "Hürthle cell reaction" has been used herein to describe the presence of these cells in various types of goiter, e.g., thyrotoxicosis or Hashimoto's disease, after irradiation of the thyroid and in the tissue remaining after subtotal thyroidectomy. When these cells are observed significantly in the thyroid, not as part of an adenoma or a carcinoma the authors have used the term "Hürthle cell reaction." The Hürthle cell reaction is to be distinguished from Hürthle cell adenoma and Hürthle cell carcinoma or adenocarcinoma. When these cells predominate in the tumor, they suggest the continued use of the terms Hürthle cell adenoma and Hürthle cell carcinoma.

These large eosinophilic cells (Hürthle cells) occurring in various types of goiters and adenomas cannot all be categorically designated as malignant. Certainly, the designation of all Hürthle cell adenomas as malignant seems reprehensible.

Illustrative cases of Hürthle cell tumors are reported to exemplify the practical problems involved and to illustrate the characteristics of this type of tumor.

The difficulties encountered in establishing the diagnosis of true Hürthle cell carcinoma or Hürthle cell adenocarcinoma are mentioned, as is their more radical, yet rational, surgical management.

## RÉSUMÉ

Pour les tumeurs de la glande thyroïde, les termes "réaction de la cellule de Hurthle" et "tumeurs bénignes et malignes de la cellule de Hurthle" devraient rester une entité pathologique distincte. La grande cellule éosinophile de Hurthle dans la glande thyroïde présente des caractéristiques frappantes. Il paraît difficile de classer [illegible] les tumeurs de ces cellules [illegible] de la variabilité de leur [illegible] n'im- [illegible] de cellules.

Les auteurs ont ici utilisé le terme de "réaction de la cel lule de Hurthle" pour décrire la présence de ces cellules dans de nombreux types de goitres, tels la thyréotoxicose, la maladie de Hashimoto, ou après l'irradiation de la thyroïde, ou dans les vestiges tissulaires après thyroïdectomie subtotale. On parle de "réaction de la cellule de Hurthle" lorsque ces cellules sont observées dans la thyroïde, sans qu'elles fassent partie d'un adénome ou d'un carcinome. La "réaction de la cellule de Hurthle" est à distinguer de celle de l'adénome, du carcinome et de l'adénocarcinome. Lorsque ces cellules prédominent dans la tumeur, il faut utiliser les termes "d'adénome de Hurthle," ou "carcinome de Hurthle".

Ces grandes cellules éosinophiles (cellules de Hurthle) que l'on rencontre dans de nombreux types de goîtres et d'adénomes, ne peuvent être catégoriquement définies comme étant malignes. Il est certainement erroné de désigner comme malins tous les adénomes de la cellule de Hurthle.

L'auteur illustre par des cas les caractéristiques de ce type de tumeur, afin de simplifier les problèmes pratiques qui en résultent.

Il énumère les difficultés rencontrées dans l'établissement du diagnostic du vrai carcinome ou de l'adénocarcinome de la cellule de Hurthle, et insiste sur leur traitement chirurgical plus radical.

## ZUSAMMENFASSUNG

Die Benennungen "Hürthle-Zellen-Reaktion" und "gutartige und bösartige Hürthle-Zellen-Geschwülste" sollten zur Kennzeichnung einer umschriebenen und eigenartigen pathologischen Einheit auf dem Gebiete der Schilddrüsengeschwülste beibehalten werden. Die grossen eosinophilen Hurthle-Zellen haben ein eigenartiges und charakteristisches Aussehen in

der Schilddrüse. Aus diesen Zellen bestehende Geschwülste lassen sich wegen der Verschiedenartigkeit des Aufbaus und der Gruppierung der Zellen offenbar schwer in Klassen und Unterabteilungen einordnen.

In der vorliegenden Arbeit wird die Bezeichnung "Hürthle-Zellen-Reaktion" benutzt, um die Anwesenheit dieser Zellen in verschiedenen Formen des Kropfes, z.B. Basedowscher oder Hashimotoscher Krankheit, nach Schilddrüsenbestrahlung und in dem nach subtotaler Schilddrüsenresektion zurückbleibenden Gewebe zu beschrieben. Die Bezeichnung "Hürthle-Zellen-Reaktion" kommt nur dann zur Anwendung, wenn diese Zellen ausdrücklich im Schilddrüsengewebe selbst und nicht in einem Adenom oder Karzinom zur Beobachtung kommen. Die "Hürthle-Zellen-Reaktion" muss also vom Hürthle-Zellen-Adenom und vom Hürthle-Zellen-Karzinom oder-Adenokarzinom unterschieden werden. Wenn diese Zellen eine hervorragende Rolle innerhalb der Geschwulst spielen, sollte man sich entschliessen, die Bezeichnungen Hürthle-Zellen-Adenom und Hürthle-Zellen-Karzinom beizubehalten.

Nicht alle diese grossen eosinophilen Zellen (Hürthle-Zellen), die in verschiedenen Formen von Kröpfen und Adenomen vorkommen, können mit Bestimmtheit als bösartig bezeichnet werden, und sicherlich ist es anfechtbar, alle Hürthle-Zellen-Adenome als bösartig anzusehen.

Zur Illustrierung der praktischen Probleme und der Eigenarten dieser Geschwulstform werden erläuternde Fälle von Hürthle-Zellen-Geschwülsten angeführt.

Ferner wird auf die Schwierigkeiten der Diagnose echter Hürthle-Zellen-Karzinome und Hürthle-Zellen-Adenokarzinome eingegangen sowie auf ihre chirurgische Behandlung, die einen zwar radikalen aber den einzigen vernünftigen Ausweg bildet.

## RESUMEN

El término "reacción celular de Hurthle" y "tumor benigno de células de Hurthle," debe ser continuado como una entidad diferente en el campo patológico de los tumores tiroideos. Las grandes células eosinófilas de Hurthle presentan una característica distinta y notable en la glándula tiroides. Parece difícil clasificar los tumores constituídos por éstas células a causa de la gran variación de su disposición celular, que puede ser casi de cualquier tipo.

El térmico "reacción celular de Hurthle" se ha usado para describir la presencia de estas células en varios tipos de bocios, tales como los de la tirotoxicosis ó enfermedad de Hashimoto, después de la irradiación del tiroides y en el remanente tisular de la tiroidectomía subtotal. Cuando estas células se observan significativamente en el tiroides, no como una parte de adenoma ó carcinoma, se usa el término "reacción celular de Hurthle." Esta reacción debe distinguirse del adenoma celular de Hurthle y del carcinoma ó adenocarcinoma celular de Hurthle. Cuando estas células predominan en el tumor se sugiere el uso del término adenoma celular de Hurthle y carcinoma celular de Hurthle.

Estas grandes células eosinófilas presentes en varios tipos de bocios y adenomas no pueden señalarse categóricamente como malignas, de hecho es censurable la designación de todos los adenomas celulares de Hurthle como adenomas malignos.

Se comunican casos ilustrativos de tumores celulares de Hurthle para ejemplificar los problemas prácticos y para ilustrar las características de este tipo de tumor.

Se mencionan las dificultades encontradas en el establecimiento del diagnóstico del verdadero carcinoma celular de Hurthle ó adenocarcinoma celular de Hurthle, así como su tratamiento más radical y racional.

## RIASSUNTO

I termini "reazione a cellule di Hurtle" e "tumori benigni e maligni a cellule di Hurtle" devono essere mantenuti per significare due aspetti ben distinti della patologia della tiroide.

Le cellule di Hurtle si presentano nella tiroide in maniera evidente e caratteristica. Non è facile classificare i tumori che ne sono provvisti, a causa della grande variabilità nell'aspetto e nella disposizione di esse.

Per "reazione a cellule di Hurtle" si intende la presenza di queste cellule in vari tipi di gozzo, nella tireotossicosi e nella malattia di Hashimoto, o nella tiroide residua dopo resezione e roentgenterapia, ma in seno al tessuto tiroideo e non nel contesto di adenomi o cancri.

Quando invece le cellule si trovano nel tumore, allora si deve parlare di adenoma o carcinoma a cellule di Hurtle.

Sono grandi cellule eosinofile che non devono, quindi, essere sempre considerate segno di malignità.

Vengono presentati alcuni casi dimostrativi di tumori a cellule di Hurtle; viene messa in luce la difficoltà della diagnosi e la necessità dell'intervento radicale nelle forme maligne.

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No picture of life today is even worth a glance that does not show the bacteria as the foundation of life itself, the broad base of the pyramid on which all the rest is erected. We know them well enough as our most terrible enemies. But man's power over the pathogenic forms advances with a certainty of purpose, a display of courage and intelligence that heartens us back to a belief in ourselves. And in truth the deathly seeds that slay us still are the least significant of the whole lot; they are expensive hothouse parasites, so finicking in their requirements, so overspecialized in their adaptations, that they have written their own doom in time.

The bacteria which fire my imagination are those that I smell as I walk these days through the dripping woods, where the sodden leaves no longer rustle. I call it the smell of loam, but of a truth loam is no more than ordinary earth rich in soil bacteria. It is their gases which I scent, as it is the emanations from other sorts that generate the fetid odor of a bog, the stench of a carcass in the woods, the delectable reek of ferment in the hay-crammed barn.

It is among these harmless sorts that there flourish species which assist to break down the naked rock that once was the five continents thrust out of the seven seas; they have made them habitable for the rest of life. Green plants—the source directly or indirectly of all the food, fuel and apparel that we use,—would find life unendurable but for the bacteria. And but for the kinds that inhabit symbiotically the digestive tracts of animals, the tough cellulose of plant food could never be dissolved and assimilated. Men, as well as insects and legumes, live out their days in an unconscious dependence upon organisms so minute that, like the angels of metaphysical monks, ten thousand may, (and frequently do) stand on the point of a needle, and so numerous that they surpass all the stars in heaven.

—*Peattie*

# Evaluation of Urologic Problems from the Medicolegal Point of View

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IN private practice, the urologist is not primarily concerned with the exciting cause of a urologic lesion. If he can make an accurate diagnosis, understand the etiologic factors and provide the treatment the pathologic process requires, the basic cause is a secondary matter. In industry, the urologist finds himself in a somewhat altered position. He has added responsibilities in his role as an industrial specialist. He must be cognizant of the fact that merely because the industrial worker is referred for a urologic opinion, it does not necessarily follow that the underlying pathologic process is confined to the genitourinary tract. He must not assume (neither must he overlook the possibility) that if a urologic lesion is present it may be the direct result of the occupational environment. An employee stricken at work is entitled to compensation and medical benefits for any condition caused by accidental injury or by an occupational disease arising out of and in the course of his employment. Therefore, the exciting cause or contributory factor of the underlying urologic lesion becomes a matter of immediate concern.

The doctor must determine whether the alleged trauma produced the present complaint of the patient or was a pre-existing condition aggravated to the point at which operation or other treatment becomes imperative. He must know whether there has been any history of a fall, blow, contusion or indirect trauma, and whether the occupational environment is in any way related to the urologic lesion. These are important questions confronting the physician who is also aware that acute symptoms in persons affected by chronic urologic disorders frequently develop after an accident occurs. All physicians are aware that the average person is prone to blame his present affliction upon a previous accident. No matter how intelligently one may approach the problem, there is often great difficulty in determining just what is to be regarded as cause and what may be attributed to mere coincidence. The differentiation becomes even more difficult because of the fact that deeply embedded in human thinking is the habit of drawing false conclusions, a habit well described by the Latin phrase, *post hoc; ergo propter hoc* (after it; therefore because of it).

Injuries and diseases of the genitourinary system and their evaluation from an industrial angle have always been moot subjects, and the cases which ultimately appear before the industrial commission are likely to be controversial; if they were not, they would never have appeared for a hearing. In the handling of these cases one must ever be aware of one's responsibility to the patient, to the employer, and to the industrial commission as well.

*Renal Calculus.*—Urolithiasis poses one of the most important problems in industrial medicine by virtue of its comparatively high incidence and the difficulty of establishing its cause and the relation th[illegible] f to i[illegible]try. Though many plau[illegible] ri[illegible] bee[illegible] d ac-

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cepted with regard to etiologic factors in stone formation, the exact cause is still unknown. All agree that no single causal factor is responsible. I have appeared in court on many occasions and witnessed efforts made by a zealous lawyer to show how trauma can produce a kidney stone. Where the injury is of such magnitude (multiple fractures) as to immobilize the patient for a prolonged period, the possibility of stone formation is never denied; but when no severe trauma has been sustained and there is no evidence of renal injury and no need of recumbency, it is erroneous to assume that trauma is a causative factor in lithiasis. What actually happens in most of these cases is that the patient's attention has been called to pain in the kidney area (renal calculus) which undoubtedly was present prior to the alleged injury and the subsequent train of events. In those states in which aggravation of a preexistent disease is accepted as having causal relevance, the role of trauma in calculosis has become increasingly hard to demonstrate. It is difficult to assume that trauma could aggravate a renal calculus by precipitating movement and migration of a stone. Such phenomena occur without trauma and often are desirable for the ultimate passage of a stone, particularly if the stone is less than 1 cm. in diameter.

When an injury has been of sufficient force to produce hematuria, the interpretation of urolithiasis from a medicolegal point of view must be carefully evaluated after full consideration of all facts. I have repeatedly emphasized the definite increase in the number of complications occurring as an aftermath of traumatic renal injuries. Renal and perirenal tissues may undergo certain changes as a result of trauma. These changes may produce obstructive uropathic change on the side involved and may, with regard to urolithiasis, be sufficient to be the causative, if not the precipitating, factor. Surely, no one can deny that a blood clot or traumatized epithelium may serve as the nucleus for a stone. If the many theories advanced with regard to urolithiasis are to be accepted, the industrial physician must consider all these possibilities when evaluating the condition of an industrial worker who presents a clinical picture of renal stone after severe injury to the kidney. The industrial physician must also take into consideration another aspect of the relation between injury and renal calculus, viz., that a calculus may exist for a long time without producing any symptoms (the so-called silent stone). Such a kidney, if subjected to trauma, may immediately display symptoms of nephrolithiasis not present prior to the alleged injury. This is in marked contrast to nephrolithiasis occurring as a result of a severe injury to a normal kidney. Under such circumstances there will be a considerable lapse of time (weeks, months or years) between the development of the calculus and the onset of symptoms referable to the calculus. This has been clearly demonstrated in many cases observed by myself, in which a kidney already containing stones and subjected to trauma immediately presented clinical symptoms of stone. This is another example of the importance of proper evaluation of the sequence of time or the train of events which in themselves may be *prima facie* evidence that the disease antedated the injury.

In all cases of renal injury and suspected renal trauma it is important to evaluate the degree of renal damage as accurately as possible. Such investigation, in addition to accurate diagnosis, enables one to guard against subsequent infections, deformities and disorders of the kidney, as well as diminish the liability of urolithiasis.

*Kidney Stone: Did a Reasonable Length of*

*Time Elapse for Development of a Pathologic Process?*—CASE 1: A 58-year-old white man, an apartment house superintendent, stated that he slipped on a flight of steps, striking his back and left side on the steps as he fell. He continued with his work. Twenty-four hours later, while at work, he felt a sudden pain in the region of the left kidney, so severe that he was nauseated, dizzy and "faint-like." On the following day (forty-eight hours after the alleged injury), he noticed blood in the urine.

His family physician referred him to a urologist, whose investigation revealed a calculus more than 1 cm. in diameter in the terminal portion of the left ureter.

The patient stated that, prior to the date of the alleged injury, he had no pain or discomfort referable to either kidney. At no time did he have frequency or urgency of urination, dysuria, pyuria, nocturia or hematuria. Since the date of the alleged injury, according to the patient, he had urinated about every ten to fifteen minutes during the day with burning, urgency and nocturia (three or four times).

Request was made for authorization of an operation, since the accident had been established and a causal relation was claimed.

*Opinion.*—In my opinion, the left ureteral calculus was not causally related to the alleged injury. The calculus was unquestionably present at the time of the alleged accident and was coincidental. *A calculus could not form within twenty-four to forty-eight hours.* The episode of severe pain, produced by movement of the stone in the ureter, would have occurred regardless of the alleged injury. There was no aggravation of a preexisting disease.

*Renal Calculus: Factor of Immobilization.*—CASE 2: A 27-year-old white man was admitted to the hospital because of fracture of the right tibia. He was placed in a walking cast and discharged from hospital but was readmitted within one month with diagnosis of pneumonia of the left lower lobe. He was discharged, but was admitted a third time with a diagnosis of left pleural effusion. It is of singular interest that on the first and second admissions microscopic urinanalysis revealed no abnormal cells but on the third admission showed occasional red blood cells and four or five pus cells per field.

The patient returned to work six months after the date of the alleged injury. After being at work for approximately ten days he first noticed gross blood in the urine. Cystoscopic study and retrograde pyelograms revealed a small calculus in the lower calyceal system of the left kidney. The patient refused operation and resumed his work. He was free of pain for about four months, after which he had an attack of left renal colic. Pyelographic studies now showed the stone in the left ureter, at the level of the left transverse process of the third lumbar vertebra. The opaque shadow on the first films measured 7 mm. in its greatest diameter; 9 mm. was its greatest diameter on the last plates taken.

*Opinion.*—The aforedescribed ureteral calculus was causally related to the fracture of the left tibia, complicated by left lobar pneumonia and left pleural effusion. The prolonged immobilization was sufficient to produce a calculus. The absence of red blood cells and white blood cells in the urine on the first and second admissions to the hospital and the positive observation of these cells on the third admission appear in logical chronologic order. It is probable that the calculus was forming during this time.

*Renal Trauma; Aggravation of a Preexisting Disease.*—In all cases of renal injury and suspected renal trauma, it is essential to evaluate as accurately as possible the degree of renal damage. It is extremely important for the industrial physician to realize that when trauma has been insignificant or comparatively mild, and the injured person nevertheless presents signs and symptoms of a renal injury, a search should be made for underlying renal disease. Coincidental pathologic conditions, when they exist, should not be accepted as the explanation of personal injury sustained. *The diseased kidney is more prone to rupture than the normal kidney,* especially if trauma plays a role. In all cases of traumatic renal damage, the possibility of a preexisting disease must be considered [illegible] most frequent of these [illegible]re: C[illegible]ies (Case 3), hydronephrosis, caluclosis, neoplasm, infection of the kidney, particularly tuberculosis, hemangiomas and nephritis.

CASE 3.—A 66-year-old-white man stated that he had been struck by an angle iron on the left side, in the region of the left kidney. Immediately after the alleged injury, gross hematuria developed. He was admitted to a hospital, where excretory urographic study failed to demonstrate any renal function on either side. Blood chemistry studies showed elevated values for nonprotein nitrogen and urea nitrogen; repeated urinanalyses showed a persistently low specific gravity with abundant albumin, numerous pus cells and many red blood cells per high power fields. The patient was examined cystoscopically and both ureteral orifices catheterized. Indigo carmine, injected intravenously, was not excreted from either side after thirty minutes. Retrograde pyelograms revealed incomplete filling of the calyceal systems on both sides. Diagnosis: bilateral congenital polycystic disease of the kidney.

*Comment.*—The prognosis in cases of this type is poor. This patient is definitely disabled and cannot engage in his former occupation. There is, however, no causal relation between his present condition and the alleged injury. The cause of polycystic disease of the kidney is purely embryologic and can in no way be due to a trauma such as that described in this man's history. The pathologic condition antedates the alleged injury and has no causal relation to the alleged trauma precipitating a transitory hematuria. Persons with polycystic congenital disease of the kidney may have episodes of hematuria without any history of a fall, blow or injury. In fact, the disease is characterized by such episodes of hematuria, coming on without any definite explanation. This eliminates the possibility of aggravation of a preexisting disease. In order that such a possibility might be accepted, the trauma would have had to be more severe, actually causing contusion or laceration of the kidney, with evidence of severe damage to the overlying structures of the left kidney, not demonstrated in this case.

*Trauma to Kidney; Significance of Subsequent Follow-Up.*—Although there has been a definite lowering of the death rate associated with trauma of the kidney, there has been a definite increase in the complications following such an injury. Those making surveys do not condemn conservative treatment of kidney injuries, but they emphasize the fact that changes in the renal or perirenal tissues do occur as a result of trauma. Such post-traumatic complications as pyelonephritis, hydronephrosis and pyonephrosis can be guarded against by adequate follow-up.

The industrial urologist must consider these possibilities when investigating an industrial worker who, with a history of renal trauma, complains of a chronic pain in the region of the formerly traumatized kidney. Such a complaint should not be erroneously attributed to neurosis, malingering or other possibilities that actually play no role in the manifestation of pain. It would be more advantageous, as is demonstrated in the following case report, to offer the patient in such a case a complete urologic check-up and determination of the exact present status of the previously injured kidney.

CASE 4.—A 56-year-old white man stated that while he was crossing a wooden ramp the boards of the ramp came apart, causing him to fall and strike his back against the boards. On the following day he felt severe pain in the lower sacral region and on two occasions noted blood in the urine. One week later, roentgen examination of the lumbosacral portion of the spine and the sacroiliac joints revealed no osseous disturbances other than minimal hypertrophic changes arising from the anterior margins of the bodies of the fourth and fifth lumbar vertebrae and calcification within the walls of the abdominal portion of the aorta, due to arteriosclerosis. Three months after the date of the alleged injury the patient was finally seen by a urologist, who expressed the opinion that the patient had probably sustained a contusion of the left kidney. "He may also have a perirenal hematoma (unresolved) at the lower pole of the kidney, because the left ureter seems to be displaced mesially. I believe this patient should be treated conservatively."

Twelve months later the patient was referred to me because of diurnal frequency of urination (six to twelve times) and nocturnal frequency (three to seven times). He denied diminution of the urinary stream, either in force or caliber, but admitted that he occasionally felt some burning on urination. Prior to the date of the alleged injury, the patient stated, he had never had urgency, frequency, dysuria, pyuria or nocturia. At this time he complained of pain in his back in the region of the left kidney. This pain did not radiate anteriorly to the abdomen, along the course of the ureter, but did radiate posteriorly downward to the left sacroiliac articulation. He also stated that he had noticed some blood in the urine about three weeks before, but that it had not reappeared.

Complete urologic investigation, including retrograde pyelographic study, showed definite pyelectasis and caliectasis on the left side. The urine from the left kidney was cloudy and contained numerous pus cells. Cultures revealed gram-negative coli of the Escherichia group. There was a definite narrowing at the ureteropelvic juncture, which was believed to be the cause of the dilatation above. This narrowing was undoubtedly the result of cicatrization following the resolution of the hematoma (traumatic) and capable of response to dilatation. This anatomopathologic condition could have been prevented by earlier diagnosis and treatment.

*Renal Calculus; Occupational Exposure.*—CASE 5: A 33-year-old white man employed by the United Nations in the capacity of a deputy secretary stated that while in India he had an attack of left renal colic. There was no history of a direct or indirect injury, blow or fall. Prior to his leaving the United States, a physical examination performed by his physician revealed no abnormalities. A routine urinanalysis at this time was reported as giving normal results.

The first attack occurred in India. He had had similar attacks while in Greece, Switzerland and France. On returning to the United States he was referred to a urologist, who, by cystoscopic and pyelographic studies, demonstrated a stone in the lower third of the left ureter. Since there was pouting of the left ureteral orifice, and since the diameter of the stone on the roentgen film appeared to be less than 1 cm., it was believed that this stone would be passed. The patient was referred to me, and on cystoscopic study I observed no evidence of stone in the left ureteral orifice. A No. 5 roentgen catheter passed on each side without difficulty, meeting no obstruction. Roentgen examination with the catheters left in place failed to show an opaque shadow in either side of the urinary tract. It is probable that if a stone had existed it had passed, although the patient could not recall having passed a stone.

*Comment.*—It was my opinion that a causal relation no longer existed, as the factors usually considered in stone formation had long since exhausted themselves, and the patient had reached the *status quo ante.* In this case it was difficult to designate an earlier causal relation, since the exact cause of stone formation is uncertain. Among the etiologic factors usually considered are: (1) climatic conditions (as in India), resulting in concentration of urine and deposition of crystals, (2) dietary imbalance and (3) the type of water supply, its availability and consistency. These may have been vital factors in the case just described.

*Post Hoc, Ergo Propter Hoc; (After It; Therefore Because of It).*—It is extremely important for the industrial physician to realize that, when trauma has been insignificant or comparatively mild and the injured person presents signs and symptoms of a renal injury, careful investigation for an underlying renal disease is imperative. Any coincidental disease that may exist should not be accepted as an explanation of the personal injury sustained. With the occurrence of an injury, even if mild and only temporarily disabling, combined with the ultimate recognition of a serious disease, such as cancer, requiring prolonged medical care, it is only natural for the injured person to state truthfully that he was well before the accident and has been continuously ill since the accident. For some unexplained reason there is a tendency for injuries to occur at the site of neoplastic disease. Ewing called this predisposition "traumatic determinism" and stated that "traumas reveal more malignant tumors than they cause." Pack and others feel that when an injury occurs to a part of the body containing a recognized tumor it may be actually beneficial to the patient, as it sometimes leads to the discovery of the tumor while cure is still possible. It is always well to remember that whenever an apparently trivial injury is said to have produced some peculiar and exaggerated effect, and a tumor is later discovered, the tumor probably antedated the injury. This is demonstrated in Case 6:

CASE 6.—A 69-year-old white man stated that, while going down the stairs in a car lubrication pit, he slipped and injured his right side, in the region of the right kidney. Because of progessive pain and inability to walk he was given immediate hospitalization. Roentgen examination of the spine revealed an osteolytic lesion of the first lumbar vertebra. Because of the possibility of prostatic cancer (prostate age) and the fact that an osteolytic lesion is metastatic, urologic consultation was requested. This revealed no evidence of malignant change in the prostate, and all tests confirmed the benignity of the prostatic enlargement that was present. With hospitalization and immobilization, voiding became increasingly difficult and was followed by retenton of urine, which was treated with an indwelling Foley catheter. Studies of the upper portion of the urinary tract were then made by excretory urographic investigation. This definitely revealed enlargement of the left kidney with changes in the renal architecture characteristic of neoplastic renal disease (left side).

*Comment.*—This case is of interest because the fall revealed the osteolytic lesion, which in turn aroused suspicion of cancer elsewhere. This was determined to be in the left kidney. The fall and blow were on the *right* side, so there could have been no aggravation of a preexisting disease by the fall, and the fall was not severe enough to traumatize the renal or the perirenal tissues. The benign prostatic hypertrophy existed prior to the date of the alleged injury and was definitely aggravated by immobilization. Had this patient been subjected to prostatectomy, it could have been said to be causally related to the alleged injury. This was not true of the carcinoma.

*Contusion of Kidney versus Tumor of Kidney.*—In most industrial injuries in which renal trauma results from a fall of a short distance or from a light blow or concussion over the kidney, the injury may consist only of a limited rupture of the renal cortex and may have no serious consequences. Such injuries are characterized by pain and hematuria, often observed only microscopically. Retrograde pyelograms may show a change in density, making it hard to arrive at a differential diagnosis between hematoma and tumor. This is demonstrated in the following case.

CASE 7.—A 65-year-old white woman stated that, while about to clean a bathtub, she slipped and fell, striking her left side against the edge of the tub. This was followed by severe pain in the region of the left kidney and left ribs. She noticed that the urine became bloody and remained so for three days. One month after the alleged injury she was still "sore" in the region of the left kidney, but had noticed no blood in the urine and had no urgency, frequency, dysuria, pyuria or nocturia.

A roentgenographic examination of the ribs and urinary tract gave no evidence of any costal fracture, either recent or old. Pyelographic examination of the left side showed an alteration in the morphologic appearance of the primary calyces within the midportion of the left kidney, suggesting the presence of a mass in this area. Reexamination in one month was advised, to determine whether these observations were constant. There were two possible assumptions as to diagnosis and causal relation: Assuming that the alteration in the architecture of the left kidney was due to a contusion of that kidney, it would then be logical to assume that the episode of pain in the region of the left kidney, followed by hematuria for three days, was causally related to the alleged injury. However, if a tentative diagnosis of neoplasm of the left kidney could be made, it would then be logical to assume that possible neoplastic disease of the left kidney would not be causally related to the alleged injury.

One month later this patient was reexamined cystoscopically, and retrograde pyelograms on the left side gave the same results as those observed on the previous examination. Again the calyces in the upper and lower portions of the kidney were normal; the calyces in the central portion of the kidney were elongated. In the absence of a history indicative of renal disease this could be accepted as a normal variation. However, the history did not warrant such an assumption, and reexamination after an interval of time was recommended.

Three months later patient was rechecked. Pyelographic examination of the left side of the urinary tract showed no dilatation of the pelves or calyces. There was no blunting or deformity of the minor calyces. The observations noted in the two previous examinations were no longer apparent. There were no changes indicative of a mass within the left kidney.

The diagnosis of contusion of the left kidney, now healed, was definitely confirmed. The episode of pain in the region of the left kidney, followed by hematuria for three days, was decided to be causally related to the alleged injury.

*Renal Trauma.*—CASE 8.—A Negro aged 33 stated that he had fallen from one floor to the one below (under construction), the fall resulting in a fracture of the right arm and injury to the head, face, abdomen and left knee. He was immediately hospitalized. On admission, urinanalysis revealed no abnormal elements in the urine and there was no history of hematuria, urgency, frequency, dysuria, pyuria or nocturia. twelve days after the date of the alleged injury it was first noticed that the patient was passing bloody urine and that he had to urinate four or five times during the day and every hour at night.

Since he showed no evidence of massive bleeding or retention of nitrogen, the results of blood chemistry studies being all within normal range, he was subjected to excretory pyelographic studies. These showed the calyces and pelvis on the left side to be irregular, particularly the left inferior minor calyx. A small amount of dye was observed in the lower pole of the left kidney, separated from the inferior minor calyx by a distance of 1 cm. This was strongly suggestive of an intrarenal tear or injury. Both ureters were partially demonstrated and appeared normal. The urinary bladder filled and emptied well.

Accident notice and causal relation had been established in this case.

Though many of these mild renal injuries subside within a comparatively short time, it is well to bear in mind that too early return to work may cause serious trouble and that bed rest is essential. In many cases of mild renal injuries showing no evidence of hematuria at the time of the alleged injury, these phenomena may become manifest when the patient is ambulatory. This seems to have been borne out in the history of the patient in the aforedescribed case.

*Calculosis versus Trauma.*—As has been pointed out, traumatic injury frequently calls attention to a calculus that existed prior to the alleged injury. The following case is presented because of definite proof of cause and effect.

CASE 9.—A 44-year-old white man slipped and fell 15 feet from a scaffold, striking the ground on his back. Roentgen examination showed no fractures, and a flat film of the abdomen revealed no opaque shadows in the region of the kidney, ureters or bladder. The patient complained of backache and headache. Five months after the alleged accident, in a flat film, a small shadow was visible (possibly a calculus) in the region of the left kidney. The patient suffered from typical renal colic, and retrograde pyelographic study revealed a stone in the pelvis of the left kidney.

The occurrence of a calculus in the left side of the urinary tract, first demonstrated five months after the date of the alleged injury and not visible in roentgenograms taken immediately after the alleged injury, shows a causal relation. It is quite possible that, as a result of the injury sustained in the original accident, there may have been sufficient damage to the left kidney to cause bleeding and permit the formation of clots, which subsequently served as the nucleus for ultimate stone formation.

*Hydronephrosis; Trauma; Death.*—CASE 10.—A 62-year-old white man fell from a scaffolding, a distance of approximately 12 feet. He was unconscious and immediately hospitalized. Catheterization (retention) was difficult because of a filiform stricture in the posterior portion of the urethra. The urine obtained was bloody. The patient died within twenty-four hours.

Postmortem examination revealed minimal prostatic [illegible] petechiae of [illegible] cosa of the anterior bladder wall were noted. There was a filiform stricture of the posterior portion of the urethra. Bilateral hydronephrosis and bilateral chronic pyelonephritis with multiple areas of abscess formation were demonstrated.

*Comment.*—This man undoubtedly was in a pre-uremic renal status. This renal damage was the result of the obstruction caused by the urethral stricture, which had probably existed for many years. The slight injury of the bladder mucosa, with blood clot formation and the subsequent acute retention, were sufficient to exacerbate the preexisting pathologic condition; so the train of events that subsequently took place was causally related to the alleged accident.

*Intravenous Pyelograms versus Retrograde Pyelograms.*—Most urologists will agree that retrograde pyelograms usually provide more precise information than the excretory type, more commonly called "intravenous pyelograms." This is well demonstrated in the following case:

CASE 11.—A young white man stated that, while going down the steps to a locker room, he slipped and, in trying to regain his balance, strained his back. After this he noticed blood in the urine, which lasted for about three days. Subsequent urinanalysis on three occasions showed red blood cells in the urine. He also complained of pain in the back, in the region of his right kidney.

Because of this history he was sent to a nearby hospital for an intravenous pyelogram. The report of this pyelogram stated, "There is no localized deformity, but a general suggestion of 'scalloping' is present on both sides. This is suggestive of *minimal polycystic disease.* No stones were found in the course of either ureter. Retrograde pyelograms suggested."

Urographic examination by the retrograde method showed complete filling of the renal sinus on the right and left sides, with no morphologic alterations. There was no evidence to substantiate a diagnosis of polycystic disease of the kidneys.

*Tuberculosis; Bilateral; Causal Relation.*—The following case is presented because of the significant train of events and the subsequent interpretation:

CASE 12.—A 45-year-old white woman employed at a tuberculosis sanatorium had frequency of urination, and a diagnosis of left renal tuberculosis was made. Since she had presumably been exposed to patients with tuberculosis, accident and causal relation had been established. She was given a course of conservative treatment, without success, and a left nephrectomy was performed. After this operation the patient made an excellent recovery and was free of all symptoms for six years. Urgency, frequency, dysuria, and microscopic hematuria and pyuria then developed.

Intravenous pyelograms showed the middle calyx of the right kidney to be blunted and typical of early tuberculous calyceal involvement. Subsequent guinea pig innoculation gave positive results for tubercle bacilli. During the interval between the patient's first operation and the subsequent involvement of the opposite kidney, streptomycin therapy for renal tuberculosis became better understood and more readily available. She was accordingly admitted to the hospital for institutional care and administration of streptomycin in conjunction with para-aminosalicylic acid therapy. The temperature remained normal; frequency, urgency and other bladder symptoms lessened, and pyelographic comparative studies indicated no further extension of the lesion in the middle calyx of the right kidney, previously described.

The question that now arose was the determination of a causal relation between the present condition of the right kidney and prior condition of the left kidney. Since accident and causal relation had been established with regard to the tuberculosis of the left kidney, it could not be denied that the same causal relation existed as far as the right kidney was concerned. It seemed reasonable to assume, and probably was testified, that a history of exposure, particularly repeated exposure, of a patient with tuberculosis, might properly be held to be exciting cause of the lesion. In cases of direct injury, such as a blow, fall or contusion, it is usually assumed that, if a focus of infection (tuberculosis) exists, injury may cause it to flare up and bring it to attention clinically, a lesion already existing in the kidney. Even when a lesion is not already in existence in the kidney, it has been assumed that an injury to an entirely normal kidney may lower its resistance to tuberculosis, so that tubercle bacilli circulating in the blood stream at the time may localize in the kidney.

*Mimicry of Symptoms; Evaluation of Character of Pain.*—The character of the pain associated with urologic disorders is paramount and often in itself is diagnostic. Because of mimicry of symptoms, particularly with regard to pain, the manifestations of pain may complicate the problem of differential diagnosis. However, the mimicry of disease is never perfect; it is misleading only to the unwary. In all instances the presence of abdominal pain or back pain should arouse suspicion of a lesion of the urinary tract. Investigation of this tract is imperative whenever there is any doubt concerning an intra-abdominal lesion, particularly with regard to appendicitis. Diseases of the kidneys and ureters frequently produce abdominal symptoms, resembling those of diseases of the stomach, the gallbladder, the spleen, the liver and even the pancreas. Similarly, lesions of the lower part of the urinary tract may be confused with appendicitis, intestinal obstruction and (in the female) inflammatory diseases of the tubes and ovaries. The most typical pain in the kidney area is that spoken of as renal colic. This is a sharp or cutting pain that starts posteriorly over the kidney and radiates anteriorly downward along the course of the ureter. It is most frequently caused by a calculus or by any pathologic process that obstructs the ureter and renal pelvis, such as a small blood clot, inspissated pus, metabolic débris (urates), kinking at the ureteropelvic juncture owing to constriction by aberrant blood vessels or fibrous bands, or by the kinking in a ptotic kidn[illegible] Metabolic débris in cases of gout in form of urates is not an uncommon cause of renal colic.

CASE 13.—A white man aged 39, had suffered repeated attacks of renal colic on the right side. He had formerly undergone bouts of gout. Several excretory urographic studies failed to reveal any pathologic change in the urinary tract, but on cystoscopic examination multiple uric acid crystals could be seen pouring from the right ureteral orifice.

CASE 14.—A 29-year-old white man complained of severe pain in the right lower abdominal quadrant. The pain radiated from the kidney area downward and medially to the right groin and testicle. These symptoms had begun about three days before, at which time urinalysis performed by the patient's physician produced microscopic red blood cells. A similar episode of pain had occurred about ten days previously. On examination a positive Murphy sign was elicited over the right costovertebral angle. Because of these findings the patient was referred to the hospital for complete urologic investigation. Cystoscopic and retrograde pyelographic studies revealed *no abnormalities of either side or genitourinary tract.*

Because of persistent high temperature, roentgen examination of the chest was undertaken, and this too showed no disease. On admission there was a high leukocyte count and the patient now had definite pain over McBurney's point, with muscular spasm and rebound tenderness. Laparotomy exposed gangrenous retrocecal appendicitis which had set *up ureteritis, producing mimicry of symptoms* as described above.

*Horseshoe Kidney; Preexisting Disease.*—Anomalies are more commonly seen in the upper part of the urinary tract than in any other system of the body. The reported evidence would seem to indicate that about 40 per cent of all pathologic conditions of the kidneys and ureters originate in congenital anomalies. Although the existence of an anomaly does not necessarily mean the presence of some pathologic lesion with definite clinical symptoms, all are agreed that any congenital abnormality of the urinary tract is potentially a clinicopathologic entity that sooner or la[illegible] ay becom [illegible] [illegible]al problem A c[illegible] abno[illegible] a shoe kidney is important rather by reason of its complications than on its own account. The possessor of such an anomaly will sooner or later show symptoms of pain and discomfort due to some associated pathologic conditions favored by pelvic dilatation, urinary stasis and subsequent infection.

CASE 15.—A restaurant manager aged 47 had a past history unimportant until one day, when he lifted a basket of oranges and experienced severe pain in his lumbosacral region. This was followed by severe pain in the left kidney. He received diathermy treatment of the back, but no attention was given to the urinary tract until he suddenly passed several small urinary concretions. About one month later he suffered from severe, sharp piercing pain in the region of the right kidney. At no time did he notice blood in the urine, but repeated urinanalyses revealed microscopic hematuria. He was now voiding about every two hours during the day and three to four times at night.

On his admission to the hospital for urologic study, cystoscopic investigation showed chronic cystitis, Grade I, a patent left ureter and an obstructed right ureter. A left pyelogram revealed marked dilatation of both major and minor calyces, and caliectasis with rotation. The possibility of a horseshoe kidney was considered, but the patient would not consent to further study and evaluation.

He was readmitted to the hospital four months later for horseshoe kidney. During the interim he repeatedly refused cystoscopic manipulation. He still complained of severe backache, more marked on the right side than on the left. A second pyelographic study was made by the excretory urographic technic, which revealed horseshoe kidney with bilateral hydronephrosis, more marked on the left side. Several calcareous deposits were visible in the lower portion of the right kidney.

A symphysiotomy (section of the isthmus) was performed, and he went back to work. There was no return of symptoms referred to the back although roentgenographically there was little improvement in the bilateral hydronephrosis. There could be no causal relation between the alleged accident and the horseshoe kidney, as horseshoe kidney is congenital. There was no aggravation of a preexisting disease, since the train of events would have followed regardless of the alleged injury sustained by lifting a basket of oranges.

## SUMMARY

Thirteen cases are presented (1) as an aid in diagnosis, (2) as an aid in interpretation of the medicolegal status and (3) as an aid to better understanding of the industrial worker. The cases are arranged so that the reader may assume and accept the diagnosis and opinion with regard to causal relation, extent of disability and treatment recommended.

## RÉSUMÉ

Treize cas sont présentés, ayant pour but:

1. d'aider au diagnostic;
2. de faciliter l'interprétation du status médico-légal;
3. d'arriver à une meilleure compréhension des travailleurs de l'ndustrie.

L'auteur passe en revue les causes, le diagnostic, l'incapacité et la thérapeutique.

## CONCLUSIONES

Se comunican 13 casos: (1) como ayuda en el diagnóstico, (2) como ayuda en la interpretación del estado médicolegal y (3) como ayuda al mejor entendimiento del trabajador industrial. Estos trabajos han sido dispuestos de manera que el lector pueda asumir y aceptar el diagnóstico y opinión con relación a la causa, extensión de incapacidad y tratamiento recomendado.

## CONCLUSIONI

Vengono presentati 13 casi che possono servire di aiuto 1) alla diagnosi, 2) all'interpretazione dei quesiti medico-legali, 3) ad una maggior comprensione delle malattie professionali.

I casi sono stati scelti in modo da consentire al lettore di rendersi conto della diagnosi, dei rapporti causali, del grado di inabilità consecutiva e della cura.

## SCHLUSSFOLGERUNGEN

Es wird über 13 Krankheitsfälle mit urologischen Problemen berichtet. Das Ziel der Arbeit ist, einen Beitrag zur Diagnostik, zur Deutung gerichtsmedizinischer Fragen und zum besseren Verständnis der Probleme des Industriearbeiters zu liefern. Die Darstellung der Fälle erfolgt in einer Weise, die dem Leser gestattet, eine Diagnose zu stellen und sich von den ursächlichen Zusammenhängen, vom Umfang der Invalidität und von der einzuschlagenden Behandlung eine Vorstellung zu machen.

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Everyone knows what it is to start a piece of work, either intellectual or muscular, feeling stale—or *cold,* as an Adirondack guide once put it to me. And everybody knows what it is to "warm up" to his job. The process of warming up gets particularly striking in the phenomenon known as "second wind." On usual occasions we make a practice of stopping an occupation as soon as we meet the first effective layer (so to call it) of fatigue. We have then walked, played, or worked "enough," so we desist. That amount of fatigue is an efficacious obstruction on this side of which our usual life is cast. But if an unusual necessity forces us to press onward, a surprising thing occurs. The fatigue gets worse up to a certain critical point, when gradually or suddenly it passes away, and we are fresher than before. We have evidently tapped a level of new energy, masked until then by the fatigue-obstacle usually obeyed. There may be layer after layer of this experience. A third and a fourth "wind" may supervene. Mental activity shows the phenomenon as well as physical, and in exceptional cases we may find, beyond the very extremity of fatigue-distress, amounts of ease and power that we never dreamed ourselves to own,—sources of strength habitually not taxed at all, because habitually we never push through the obstruction, never pass those early critical points.

For many years I have mused on the phenomenon of second wind, trying to find a physiological theory. It is evident that our organism has stored-up reserves of energy that are ordinarily not called upon, but that may be called upon: deeper and deeper strata of combustible or explosible material, discontinuously arranged, but ready for use by anyone who probes so deep, and repairing themselves by rest.

# Ovarian Pregnancy

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OF the many causes of intra-abdominal hemorrhage, extrauterine pregnancy, with its complications, is perhaps the most elusive to diagnosis, although it may well be much less rare than was formerly supposed. Certain reliable syndromes help in the somewhat difficult diagnosis of what may be termed a veiled ectopic gestation.

The first description of ovarian pregnancy has been variously ascribed to Mercer[1] and to Maurice[2] in 1682. In 1878 Spielberg[3] described the condition, while Tussenbrock[4] is credited with the first histologic description in 1899. During the present century many writers have added to the general knowledge of extrauterine pregnancy.

The case to be described emphasizes the importance of considering the possibility of ectopic gestation in women of the reproductive age, although the usual signs of such a condition may be absent.

*Incidence.*—Ectopic gestation is most common in multipara and often follows a period up to ten years of sterility. Rogue[5] stated that it occurs most frequently near the end of the childbearing period. The ovarian type is the rarest and has been stated by Isbell and Bacon[6] to occur only once in every 25,000 pregnancies. Ganz and Ennis[7] estimate that it forms less than 1 per cent of all extrauterine pregnancies.

It may well be that if all ectopic pregnancies were microscopically investigated the incidence of the ovarian type might be discovered to be much less rare than these figures would indicate. It may be that it would explain cases of ovarian hemorrhage which are encountered from time to time but have escaped recognition.

*Etiologic Factors.*—The cause of extrauterine gestation is still shrouded in mystery. Physiologists have shown experimentally that fertilization occurs in the fallopian tube and that the ovum is then propelled into the uterus by the cilia lining the tube. Any obstruction of the lumen may cause the ovum to develop or to remain undeveloped in the tube, or to be expelled outward to form an ovarian or an abdominal pregnancy. Intrauterine and extrauterine pregnancies may develop simultaneously, as happened in the case to be reported.

It would appear that the possible causes might be classified as congenital and acquired. Congenital conditions of the tube may be kinks, diverticula or stenosis, or there may be a deficiency in the cilia and the mucous lining. Freund and Frommell[8] attached importance to narrow, tortuous tubes, and in these cases the possibility of a defective lining cannot be ignored.

Acquired mechanical obstruction may result from retrodisplacement of the uterus, the presence of small tumors, stenosis following inflammation and torsion resulting from adhesions. Although no anatomic or

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physiologic difference has been detected in the two tubes, ectopic pregnancy is more frequent on the left side than on the right.

Inflammatory causes may be abortion, endometritis or gonorrheal, tuberculous or puerperal infection. Endometritis has been observed in a number of cases.

Other acquired causes may be prolonged sterility resulting from previous inflammation or glandular deficiency, and, psychologically, fright or profound emotion at the time of conception. In most cases the train of events appears to be as follows: mechanical deformity, inflammation, a period of sterility and an abnormal ovum.

### REPORT OF CASE

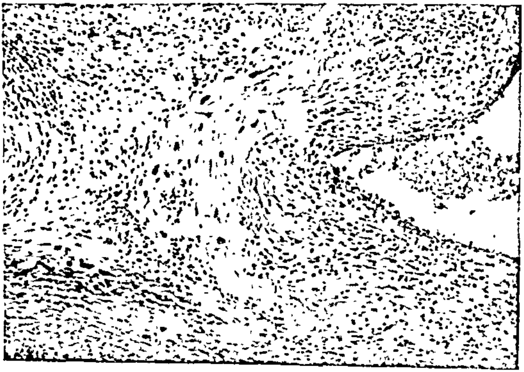
In September 1947, Mrs. F., aged 38 years, complained of intermittent generalized abdominal pain, menorrhagia and loss of weight during the past year. Her previous history was not significant. Menstruation had commenced at the age of 12 and until recently had given no trouble. Three years prior to admission a simple adenoma had been removed from the left breast.

The abdominal pain, which at first recurred about every ten days but was always worse during menstruation, had recently become more severe and of daily occurrence. It commenced at the pit of the stomach and radiated to all parts. Nausea was absent, but the patient felt faint before the onset of the pain, experiencing an urgent desire to micturate. She ate well, and as a rule her sleep was not disturbed.

Of blond complexion, she looked older than her years; she was underweight and pallid. The breasts were large and firm and showed dilation and prominence of the superficial veins. The suggestion of an early pregnancy was further confirmed by a decrease in the general translucency of the glands on transillumination.

The skin of the abdominal wall was normal, but there was resistance on pressure over the muscle of the left iliac fossa. The uterine fundus was palpated at the symphysis pubis as in a three months' pregnancy. A mass, about the size of a small orange and having the clinical characteristics of an ovarian cyst, was felt in the left iliac region, where the percussion note was slightly dull and the peristaltic movement sluggish.

Examination *per vaginam* revealed a patulous and eroded cervix and a soft, enlarged uterus. A subserous fibroid about the size of a hen's egg occupied a site near the fundus. What was taken to be a left ovarian cyst was



Photomicrograph, × 120, taken in case [illegible] uterine pr[illegible] (see t[illegible]) freely mobile, soft, fluctuant and tender on pressure. The pouch of Douglas and the rest of the pelvic cavity presented no abnormality.

Wassermann and Kahn tests gave negative results. The blood picture showed no abnormal cells. The white cell was normal, but there was a slight decrease in the number of red cells.

A diagnosis of intrauterine pregnancy, complicated by a subserous pedunculated fibroid and a left-sided ovarian cyst, was made, and operation was performed through a transverse incision by the electrosurgical technic. The advantages of these methods have been fully described in previous papers, but in a case of this kind the benefit of the free exposure given by the transverse incision must be obvious. At operation the clinical impressions were confirmed, except that the left ovary was very dark and was adherent to the omentum. The fibroid was removed and a left salpingo-oophorectomy performed. With the exception of a slight vaginal hemorrhage, which persisted for only twenty-four hours, convalescence was uneventful. The patient was dismissed well on the thirteenth day after the operation.

*Pathologic Picture.*—To justify a diagnosis of ovarian pregnancy the tube, including its fimbriated extremity, must be shown to be intact and separate from the ovary; the gestational sac must occupy the normal position of the ovary and be connected with the uterus by the utero-ovarian ligament, and ovarian tissue must be demonstrated in the walls of the sac.

The ovary removed in this case was enlarged, measuring 2 by 1½ by 1½ inches (5 by 3.7 by 3.7 cm.). Several simple cysts of the follicular type were present, but the enlargement was mainly due to a cyst, 1 inch (2.5 cm.) in diameter, containing chocolate-colored material surrounded by hemorrhagic walls. The fimbriated end of the tube, though lightly adherent, was not involved in the cyst.

Microscopically, lutein cells were observed in the ovarian stroma, while the stromal cells toward the surface of the gland appeared to have undergone a decidual change. The large cyst contained a mass of blood clot, embedded in which were typical, though almost completely necrotic, chorionic villi. The ovary was definitely demonstrated to be the seat of the dead product of an ectopic gestation. Organization was present on one side, and the ovarian tissue was extensively involved in the pregnancy.

## COMMENT

This case presents some interesting features and problems. In a case of dual pregnancy the Aschheim-Zondek test gave a negative result, and none of the classic signs of ectopic gestation was present. The condition was not suspected prior to operation. The case suggests the wisdom of keeping in mind this possibility in the treatment of every pelvic lesion occurring in a woman of childbearing age, especially in the latter part of the period.

The tumor of epithelial origin of the mammary gland, the mesoblastic tumor of the uterus and the coexisting intrauterine and extrauterine pregnancies raise the interesting speculation of a predisposition to neoplastic development, possibly due to glandular imbalance.

The causal factors are imperfectly understood, but they may be associated with the greater incidence of pathologic conditions in the left side of the pelvis. Probably the site of implantation of the spermatozoa is a graafian follicle which may be entered directly by puncture or when it ruptures. Fertilization of the egg cell may take place on the surface of the ovary, and the ovum may then invade the ovary by erosion. As development continues, the ovary becomes filled with blood clot containing an amniotic cavity, chorionic villi being present. The capsule is formed by ovarian tissue, while particles of decidual tissue are present in the medulla and in the cortex. The termination is usually rupture unless the ovary is removed in advance of this stage. In cases in which rupture does not occur, a mole may form.

The present case indicates the advantages of certain methods not generally practiced. We have noted in many instances that transillumination is a reliable test for pregnancy and other disturbances of the breast. The transverse incision and the electrosurgical technic offer many advantages over methods formerly used.

## SUMMARY

The actual cause or causes of extrauterine pregnancy are not definitely known, but the condition should be kept in mind in dealing with pregnant patients. A case is reported in which intermittent generalized abdominal pain, menorrhagia and loss of weight led to examination and diagnosis. Operation confirmed the preoperative impression, and surgical treatment brought about successful results, the only postoperative complication being slight vaginal hemorrhage for twenty-four hours.

## RÉSUMÉ

Les causes de la grossesse extra-utérine ne sont pas encore élucidées, mais il faudrait toujours envisager cette possibilité chez les malades enceintes. Les auteurs rapportent un cas où les syndromes (douleurs abdominales généralisées intermittentes, ménorragie et perte de poids) ont nécessité l'examen de la malade. L'opération confirma l'impression qu'il s'agissait d'une grossesse extra-utérine. Suites opératoires: fiable hémorragie vaginale durant 24 heures.

## ZUSAMMENFASSUNG

An extrauterine Schwangerschaft muss bei schwangeren Kranken immer gedacht werden, wenn auch die eigentliche Ursache oder Ursachen der Erkrankung unbekannt sind. Es wird über einen Fall berichtet, in dem das wiederholte Auftreten allgemeiner Bauchschmerzen, Menorrhagie und Gewichtsverlust zur Untersuchung führten und die Diagnose gestellt wurde. Die Operation bestätigte die Diagnose, und der Eingriff führte zur völligen Heilung. Die einzige Komplikation nach der Operation bestand in einer leichten 24 Stunden anhaltenden vaginalen Blutung.

## RESUMEN

La causa ó causas actuales del embarazo extrauterino no se conocen en forma definida, pero el padecimiento debe tenerse presente cuando se trata con pacientes embarazadas. Se comunica un caso en el cual un dolor abdominal, intermitente y generalizado, menorragia y pérdida de peso, dieron lugar al examen físico y al diagnóstico. La operación confirmó la impresión preoperatoria y el tratamiento quirúrgico produjo resultados satisfactorios, la única complicación postoperatoria fué una ligera hemorragia vaginal que duró veinticuatro horas.

## RIASSUNTO

Le cause della gravidanza extrauterina non sono ancora conosciute, ma questa possibilità deve essere tenuta presente in ogni caso di gravidanza.

Viene riferito un caso in cui si giunse alla diagnosi a causa di dolori addominali diffusi intermittenti, metrorragie e dimagrimento. La donna fu operata con successo e l'unica complicazione post-operatoria fu una lieve perdita ematica dai genitali nelle prime 24 ore.

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# Mesenteric Vascular Occlusion

## Report of a Case with Resection, Survival and Five-Year Follow-Up

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MESENTERIC vascular thrombosis is considered a rare disease. There are reports of occasional cases or small groups of cases, but in 30,000 consecutive admissions to the New Orleans Charity Hospital only 13 cases were encountered.[1] The incidence is generally quoted at about 0.1 percent of all surgical admissions to a general hospital. The condition must be more common than these figures indicate, however, for every surgeon seems to have observed one or more cases of this disease.

The male is affected more commonly than the female, in a ratio of about 3 to 2. The condition may occur at any age but it is most common in persons between 50 and 60. Cardiac conditions, especially fibrillation, are well known to be the cause in some cases. But what is not generally appreciated is that many other predisposing etiologic factors exist; for example, intra-abdominal infection, hernia, adhesions and torsions. Most important, in many cases no cause can be established.

Mesenteric vascular occlusion may be either venous or arterial. In the majority of cases it is arterial.[2] However, venous occlusion is usually followed shortly by arterial thrombosis and vice versa, so that by the time the specimen reaches the pathologist it is difficult, if not impossible, for him to determine which came first. The occlusion may be due to an embolus or a thrombus, but thrombosis seems to be more common according to recent studies.[3] The superior mesenteric vessels account for 90 per cent of cases and the inferior mesenteric for about 10 per cent. Arterial occlusion produces an anemic infarct, especially if it occurs in an already narrowed vessel. Venous occlusion leads to hemorrhagic infarction. At an early stage edema is present, bluish or purplish spots are observed, the serosa is still glistening, and straw-colored fluid is present in the peritoneal cavity. The mesentery is thickened, and black thrombosed cords may be seen or palpated. Later the intestine appears more congested, and finally the overfilled capillaries burst, pouring blood and plasma into the lumen of the bowel as well as into the abdominal cavity. At this stage the peritoneal exudate is, of course, hemorrhagic, the degree depending on the state of the disease. It is this loss of circulating fluid that accounts for the severe picture of shock so often observed in these cases. Eventually the bowel becomes gangrenous. The proximal portion of the bowel is surprisingly little dilated owing to the lack of real obstruction, since this condition represents a non-acting loop rather than a true mechanical obstruction. Because of the many arcades and the rich collateral circulation, the bowel should be able to maintain its viability, but secondary extension of the clot into the adjacent arcades precludes the recovery of the bowel. Although spontaneous recovery has been reported and may occur, it must be regarded as a surgical curiosity rather

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than as a likely occurrence.

The symptoms of the two types of thrombosis are similar, but they are much more dramatic in arterial occlusion. They consist of abdominal pains, cramps, vomiting, diarrhea, gradual abdominal distention which never reaches great proportions, and, possibly, blood in the vomitus or the stool. Shock is present early in cases of arterial occlusions and later in cases of venous occlusions. Peritonitis is a late manifestation. In about 10 per cent of cases a vague, doughy mass may be palpated.

The diagnosis is rarely made preoperatively. Examination of an elderly patient with abdominal pain of sudden onset, mostly left-sided, with little rigidity, moderate abdominal distension and abdominal sounds that are first moderately active, and then absent, producing a silent abdomen, should make one suspicious. A roentgen plate of the abdomen shows dilated loops of small bowel, limited in extent. The combination of a clinical picture suggestive of large bowel obstruction with roentgen evidence of moderate dilation of limited loops of small bowel is highly suggestive of this diagnosis. As with so many conditions in medicine, one must first think of the condition if one is to diagnose it. A high index of suspicion should lead to more preoperative diagnoses.

The treatment of choice is operation, with resection of the involved bowel and its mesentery. This gives the patient his only chance for survival. The amount of bowel that can be successfully resected is amazing, all but 8 inches (20 cm.) of it having been resected with patient surviving.[4] The diarrhea is difficult to control, but it can be managed, and control improves with time. The operative mortality rate is high, ranging from 32.6 to 84 per cent in different reports, with the average about 62 per cent. Treatment with anticoagulants and antibiotics should be reserved for patients who refuse operation or who are deemed hopelessly inoperable. Postoperatively, anticoagulants and antibiotics should be given.

### REPORT OF CASE

Mrs. S. S., a 70-year-old white woman, was admitted to Lebanon Hospital on Sept. 25, 1949, with a two-and-a-half day history of severe pain in the left lower abdominal quadrant, followed twenty-four hours after its onset by nausea and vomiting. The pain was aggravated by physical activity and had persisted undiminished since that time. There had been no bowel movements for two days, and no flatus had been passed for the previous twenty-four hours. An enema given at home was "not satisfactory." The past history revealed that this patient had been having recurrent attacks of pain in the left lower quadrant for several months. A right inguinal hernioplasty had been performed in 1917, and an abdominal operation of unknown nature in 1918.

Physical examination on admission revealed an acutely ill, dehydrated patient with sunken eyes, a dry tongue and dry skin. The temperature was 101 F. and the pulse rate 114. The abdomen was distended all over and tenderness was present throughout, most marked in the left lower quadrant and the epigastrium. No rebound tenderness could be elicited, and no masses were palpable. Rectal and rectovaginal examination revealed some tenderness in the cul de sac and on moving the cervix, but no masses were palpated. No feces were observed in the rectum. Laboratory tests revealed 3,350,000 red blood cells per cubic millimeter, with 10 Gm. of hemoglobin, and 15,500 white blood cells, with 83 per cent polymorphonuclears (band cells 30) and 17 per cent lymphocytes. The urine gave a 3 plus reaction for sugar; traces of albumen and of acetone were present, microscopic examination revealed many granular casts. The impression on admission was that this patient had an intestinal obstruction, probably due to neoplasm and possibly due to adhesions. An enema was given and reported as giving no results, neither flatus nor stool being passed. A flat plate of the abdomen was taken, which revealed filled loops of small bowel with fluid levels but no evidence of dil [illegible] ion of the large bo [illegible] of the [illegible] poor condition a Miller-Abbott tube was passed and suction was started. She was given intravenous fluids, blood transfusions and large doses of penicillin in preparation for possible surgical intervention. She was again seen five hours later, at which time there was no improvement in either her physical condition or the physical abnormalities. An exploratory laparotomy was deemed advisable.

With the patient under general anesthesia, the abdomen was opened with a right rectus incision. A large number of adhesions were observed. There was also a large amount of dark hemorrhagic exudate in the peritoneal cavity and about 4 feet (121.9 cm.) of black, completely gangrenous bowel with a very foul odor, typical of gangrene. The remainder of the bowel had pinpoint hemorrhagic spots on the mesenteric side. When the bowel was opened for the anastamosis the lumen was seen to be filled with hemorrhagic material. About 4 feet (121.9 cm.) of this gangrenous bowel, together with about 4 inches (10 cm.) of relatively normal intestine on each end was resected, together with its adjoining mesentery, and an end-to-end anastamosis was performed in two layers by the open method. The abdomen was closed in layers without drainage.

*Postoperative Course.*—The highest postoperative temperature was 101 F., and the patient passed flatus forty-eight hours after the operation. Her convalescence was complicated by superficial thrombophlebitis, which responded rapidly, and by diarrhea. The latter was controlled with moderate difficulty. The wound healed *per primam*, and the patient was discharged home fifteen days after the operation, apparently in good condition.

*Pathologic Report.—Gross Specimen*: The specimen consisted of a loop of small intestine measuring 95 cm. in length and 3 cm. in diameter. At the proximal and distal ends the bowel was normal in appearance for a distance of several centimeters. The remainder of the specimen was dark purplish red. Attached to the loop was a segment of mesentery; this was bright red, with the appearance of fresh hemorrhage. On dissection, several of the veins are observed to contain fresh, soft, dark red thrombi. Representative sections were taken for histologic examination.

*Microscopic Picture*: The sections revealed diffuse hemorrhagic infarction of all coats of the bowel and of the fat tissue of the mesentery. Many of the larger veins were filled with fresh thrombi. The remaining blood vessels were strikingly engorged. There was no histologic evidence of organization of the thrombi; however, several vein walls showed early necrosis.

*Gross and Microscopic Diagnosis*: The diagnosis was hemorrhagic infarction and necrosis of the small intestine, due to thrombosis of mesenteric veins.

*Follow-up Examination*: This patient has been seen at regular intervals since her discharge, and up to the time of this report has been well and has had no difficulty (four years, and ten months). The diarrhea has subsided, and the patient is well and carrying on normal activities, including her own housework.

## COMMENT

Mesenteric vascular occlusion is a dramatic and catastrophic abdominal emergency. It is apparently more frequent then is generally supposed, and recognition of the condition, with immediate surgical intervention, may result in cure. Spontaneous recovery is rare, although cases have been reported in which laparotomy revealed the thrombosis in the superior mesenteric artery and the patient recovered without resection of the lesion. Treatment with anticoagulant therapy is required in all such cases, either instead of surgical intervention or subsequent to it; however, these agents should not be relied upon as the sole method of treatment, if operation is possible. Uricchio, Calanda and Freedman[5] collected all the cases reported in the literature of patients who have survived intestinal resection for this disease. They noted a total of 158 cases, together with the ones they reported. The case here presented will bring the total to 159.

## CONCLUSIONS

Mesenteric vascular occlusion is an uncommon but highly significant disease which is amenable to surgical intervention, and the patients can survive resection. Enormous amounts of bowel have been resected, with survival. The physiopathologic picture of obstruction to the mesenteric blood supply is briefly described. A case of mesenteric vascular occlusion is reported, in which resection of a little over 4 feet (121.9 cm.) of small bowel was performed, with a five-year survival. This brings the total number of reported cases of resection and survival to 159.

### *CONCLUSIONES*

La oclusión vascular mesentérica es un padecimiento raro pero altamente significativo que es tratable por intervención quirúrgica y cuyos pacientes pueden sobrevivir a la resección. Grandes cantidades de intestino han sido extirpadas con supervivencia.

Se describe brevemente la imagen fisiopatológica de la obstrucción, de la vascularización sanguínea mesentérica.

Se comunica un caso de oclusión vascular mesentérica en el que se realizó una extirpación de más de 4 pies (121.9 cm.) de intestino delgado, con una supervivencia de cinco años. Esto hace un total de 159 casos comunicados de resección con supervivencia.

### *SCHLUSSFOLGERUNGEN*

Der Verschluss von Mesenterialgefässen gehört zu den seltenen aber höchst bedeutungsvollen Erkrankungen, die chirurgischer Behandlung zugänglich sind. Die Kranken können die Resektion überleben. Aeusserst umfangreiche Darmresektionen können überstanden werden.

Das physiopathologische Bild der Verstopfung der mesenterialen Blutversorgung wird kurz beschrieben.

Es wird über einen Fall von Mesenterialgefässverschluss berichtet, in dem etwas mehr als 122 Zentimeter Dünndarm reseziert wurden und der Kranke fünf Jahre nach der Operation am Leben war. Damit steigt die Gesamtzahl der veröffentlichten überlebenden Fälle auf 159.

### RÉSUMÉ

L'occlusion artério-mésentérique est une affection rare mais sérieuse, justiciable d'une intervention chirurgicale. Les malades peuvent survivre à la résection, malgré les énormes masses d'intestins resequées.

Brève description de l'image physiopathologique de l'obstruction.

Rapport d'un cas, avec résection de plus de 1,20 m d'intestin grêle. Nombre total des cas rapportés à ce jour, avec résection et survie: 159.

### CONCLUSIONI

L'occlusione dei vasi mesenterici è evenienza rara ma assai grave e dominabile chirurgicamente. E' possibile, infatti, sopravvivere a estesissime resezioni intestinali.

Viene esposta la fisiopatologia dei vasi mesenterici e descritto un caso in cui si eseguì una resezione du tenue di 122 cm.

Il paziente sopravvive da 5 anni e va ad aggiungersi ad altri 159 casi favorevoli della letteratura.

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# Twenty-Four Hour Neomycin Preparation for Intestinal Operations

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NEOMYCIN was isolated by Waksman and Lechavalier[1] in 1949 from a culture of Streptomyces Fradaie. This drug has been used topically for local infections. At present it is being used for intestinal antisepsis, because only about 3 per cent of neomycin is absorbed from the intestinal tract;[2] in addition, the consensus is that resistant bacterial strains rarely develop. The physical and chemical properties have been described by Poth and his co-workers[3] and by Pulaski.[4] Poth[5] set forth requirements for an ideal intestinal antiseptic, most of which are fulfilled by neomycin. The aforementioned authors, however, have been using neomycin in combination with other drugs: Pulaski[4] and Poth,[5] sulfathalidine; Dearing and Needham,[6] terramycin, and Meleney and Johnson,[7] bacitracin. These investigators used the combined antibiotics for a period of at least three days. Since neomycin has already proved to be bacteriocidal or bacteriostatic to the intestinal flora within twenty-four hours, we decided that longer preparation would not be needed and that neomycin in itself would suffice. The following investigation, therefore, was undertaken:

*Clinical Material.* — Thirty-four cases were studied, 19 of malignant and 15 with benign disease. In the malignant group (in all of which there was some degree of obstruction) the lesions were all carcinoma in various locations in the colon or the rectum. The benign group included hemorrhoids, polyps, closure of colostomy, colectomy, appendiceal fistula and diverticulitis. The average age of the patients was 50; most of them were 60 to 75 years of age, but the ages varied from 13 to 82 years.

*Procedure.*—Neomycin in itself does not prepare the bowel mechanically, that is, it does not liquefy the stools, and therefore the following procedure was instituted: A low residue diet was prescribed seven days prior to the operation. One teaspoon of phospho-soda solution was given twice a day for one week. In two or three days the patient began to have loose stools. The phospho-soda solution was discontinued when administration of neomycin was begun, which was thirty-six to forty-eight hours before the operation, as we prefer that our patients have an undisturbed night's sleep before the operation. One Gm. of neomycin sulfate by mouth was given hourly to four doses. (With the fourth dose an ounce of phospho-soda solution may be optionally given. Some vomiting may be encountered with the fourth dose of neomycin and phospho-soda, but is of no consequence.) One Gm. of neomycin orally was administered every four hours until a total of 10 Gm. of the drug had been given or a period of twenty-four hours had elapsed since it was begun.

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The neomycin tablets (Mycifradin—®) *for this study were* supplied by Dr. Harold R. Reames of the Upjohn Company, Kalamazoo, Michigan.

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A sodium bicarbonate enema was given routinely on the night before the operation. A bowel culture in the form of a rectal swab was taken before neomycin was started. An intestinal culture was also done at the time of the operation and daily thereafter for about ten days. Plating was done by the usual methods on eosinmethylene blue media for coliform bacteria and azide blood agar media for enterococci and staphylococci.

*Results.*—At the time of operation, the large bowel, which had been prepared with neomycin, was contracted and sterile for aerobes, and the mucosa was not irritated. In 17 cases in which neomycin was used preoperatively and no antibiotics were given postoperatively there were no complications, and the postoperative course was smooth. The bowel remained sterile on an average of five and one-half days after the operation, varying from four to ten days.

In a second group, 17 patients were prepared with neomycin and postoperatively were given 400,000 units of procaine penicillin G and 0.25 Gm. each of streptomycin and dihydrostreptomycin sulfates twice daily. Five complications developed in this group, three of which (sterile abscess with obstruction, prostatitis and pulmonary embolus) we do not attribute to the drugs. However, staphylococcus enterocolitis developed, postoperative in 2 cases, which will be reported in this paper. The duration of intestinal sterility was the same as in the first group—an average of five and one-half days, varying from three to more than seven days.

Aerobacter aerogenes was cultured in 3 cases at the time of operation. We were unable to sterilize the bowel with neomycin in 2 cases of hemorrhoids and 1 of ulcerative colitis. If the bowel is prepared with more than 10 Gm. of neomycin there is an overgrowth of organisms, particularly staphylococci. One patient was given a double preparation, and staphylococcic overgrowth was observed.

The cases in which enterocolitis developed after the postoperative administration of penicillin and streptomycin are here reported.

Case 1.—A white girl aged 13 years had an appendiceal abscess which had developed eight months prior to admission. It was drained. A fistula developed, which did not close during an eight-month interval. The patient was admitted to the hospital and prepared with the usual twenty-four hour neomycin regime as outlined. Postoperatively she was given 400,000 units of procaine penicillin G and 0.25 Gm. of streptomycin and dihydrostreptomycin each, twice daily for five days. On the fourth postoperative day loose stools, diarrhea and excoriation of the buttocks were present. Stool cultures revealed large numbers of Staphylococcus pyogenes. The penicillin, streptomycin and dihydrostreptomycin were discontinued and 800 mg. of erythromycin was given orally in 4 divided doses daily for two days, after which the symptoms subsided.

Case 2.—A 72-year-old white woman with carcinoma of the rectosigmoid was treated with the same preoperative and postoperative regime as was employed in Case 1. The symptoms of enterocolitis developed on the fourth postoperative day. She was treated with erythromycin, as was the first patient. The symptoms subsided in two days. The cultures were similar.

The symptoms in both cases were itching (pruritus ani), loose stools and sore throat. The clinical signs were red, beefy tongues, inflamed buccal mucosa with some white patches and excoriated red buttocks.

The twenty-four hour neomycin preparation of the bowel for operation has been adequate for sterilization as far as aerobic bacteria are concerned. We did not do anaerobic cultures, as we did not consider it necessary; if the bowel is sterile for aerobes, the anaerobes are unable to become pathogenic without the symbiotic effect of the aerobes. Most complications caused by spillage or leakage are due to the aerobic group of bacteria. All of our anastamoses were done by the open method. The one abscess we encountered was sterile.

The tetracycline drugs were not used

in combination with neomycin preoperatively, since they may cause mucosal ulcerations of the digestive tract, particularly about the suture line. When neomycin is used alone, the healing of the sutured bowel appears to be accelerated and the healing stage of the anastomosis on the third postoperative day appears to progress to a point where it would normally be on the fifth postoperative day. We have had occasion to visualize the suture line, which confirmed this impression. The colon is contracted when prepared with neomycin, and the mucosa is not irritated, which is a desirable state for operations on the large bowel.

Neomycin allows the flora to return in a satisfactory manner, and this commences on the third or fourth postoperative day. In our opinion, antibiotics, given either in conjunction with neomycin or postoperatively, interfere with the return of the flora. This is undesirable, as we have encountered two cases of staphylococcus enterocolitis in the group of patients who were given antibiotics postoperatively. In a pilot study, neomycin was given in combination with oxytetracycline as a part of the preoperative preparation. In this small group, staphylococcic enterocolitis developed in 3 cases. Apparently these other antibiotics interfere with the return of the flora, disturbing the symbiosis and permitting an overgrowth of Micrococcus pyogenes. We are of the opinion, therefore, that neomycin in itself is adequate and that no antibiotic drugs should be given with it, either preoperatively or postoperatively, except when indicated. A sixteenth requirement should be added to those of Poth[8] for an ideal intestinal antiseptic; the drug should not interfere with the return of the flora.

We have observed no untoward effects, complications or undesirable features that we can attribute to neomycin. Occasional nausea and vomiting were observed, which readily subsided and presented no indication for discontinuance of the drug. The bowel can be adequately sterilized in most instances with 9 or 10 Gm. of neomycin over a twenty-four hour period. In fact, we are convinced that a smaller amount of the drug would be satisfactory and experiments with a smaller dosage are now under way. The smallest amount of a bacteriocidal or bacteriostatic agent should be used which will sterilize the bowel for an adequate period and will not interfere with the return of the flora. The return of the flora does not interfere with healing and may even enhance it. This was vividly illustrated in a patient who was given 10 Gm. of neomycin after biopsy of a lesion in the rectosigmoid. Ten days later he was operated upon, again being prepared with 10 Gm. of neomycin. The culture taken at the time of operation showed an overgrowth of staphyloccoccus, which was not observed after the first administration of the drug.

Our experiments indicate that a great deal of hospital time can be saved with this drug, reducing the number of days in the hospital for each surgical procedure, making more beds available and, in the last analysis, involving considerably less expense for the patient.

## CONCLUSIONS

1. Neomycin alone is a satisfactory adjunct in preparing the bowel for operation.
2. Neomycin in itself does not prepare the bowel mechanically (i.e., it does not liquefy the stools).
3. Antibiotics should not be used routinely in the postoperative management of patients undergoing intestinal operations after preparation of the bowel with neomycin.
4. The bowel is sterile for aerobic bacteria with the twenty-four neomycin regime at operation and, on the average, for five and one-half postoperative days, but this sterility may be maintained for

three to ten days.

5. The postoperative use of penicillin and streptomycin does not increase the average duration of intestinal sterility and may interfere with the return of the flora.

6. Preoperative hospitalization is diminished by use of the twenty-four hour neomycin regime.

### RESUMEN

1. La neomicina sola es un axiliar satisfactorio para la preparación intestinal preoperatoria.

2. La neomicina no hace por sí misma la preparacióm mecánica del intestino (v.g. no licúa las evacuaciones).

3. No deben usarse rutinariamente antibióticos en la atención postoperatoria de pacientes intestinales operados cuyo intestino haya sido preparado con neomicina.

4. El intestino es estéril en lo que atañe a las bacterias aerobias con el método de veinticuatro horas de neomicina preoperatoria y por término medio, durante cinco y medio diás postoperatorios pero dicha esterilidad puede mantenerse de tres a diez días.

5. El uso postoperatorio de penicilina y estreptomicina no aumentan la duración media de esterilidad intestinal y pueden impedir el retorno de la flora.

6. El método del uso de neomicina por veinticuatro horas disminuye la hospitalización preoperatoria.

### RIASSUNTO

1. Soltanto la neomicina dà risultati soddisfacenti nella preparazione dell'intestino agli interventi.

2. La neomicina non prepara, di per sè stessa, l'intestino agendo meccanicamente (non rende, cioè, le feci liquide).

3. L'uso degli antibiotici non è sempre necessario nella cura post-operatoria dopo interventi sull'intestino, quando, per la preparazione, sia stata usata neomicina.

4. Con un trattamento di neomicina protratto per ventiquattro ore, l'intestino è privo di batteri aerobici all'atto dell'intervento e, in media, per cinque giorni e mezzo dopo—ma tale sterilità può mantenersi dai tre ai dieci giorni.

5. L'uso post-operatorio di penicillina e streptomicina non prolunga la durata media della sterilità intestinale e può ostacolare il ristabilimento della flora normale.

6. La durata della spedalizzazione preoperatoria risulta diminuita usando, nella preparazione agli interventi sull'intestino, neomícina per ventiquattro ore.

### RÉSUMÉ

1. La néomycin seule est un adjuvant préopératoire satisfaisant pour les opérations intestinales.

2. La néomycine par elle-même ne purge pas (par exemple, elle ne liquéfie par les selles).

3. Les antibiotiques ne devraient pas être utilisés d'une façon courante dans le traitement post-opératoire des intestins après préparation préopératoire à la néomycine.

4. L'intestin devient stérile aux bactéries aérobies avec la néomycine durant 24 heures dès la fin de l'opération; cette stérilisation dure en moyenne 5 jours et demi après l'opération, mais elle peut être maintenue durant trois à 10 jours.

5. L'utilisation post-opératoire de pénicilline et de streptomycine n'augmente pas la durée de la stérilisation intestinale; elle peut empêcher le retour de la flore intestinale.

6. L'hospitalisation pré-opératoire est diminuée par la cure de 24 heures de néomycine.

### SUMARIO

1. Apenas a neomicina constitue um elemento útil no preparo do intestino para operação.

2. A neomicina por si própria não prepara o intestino mecânicamente (ela não liquefaz as fezes).

3. Antibióticos não devem ser usados rotineiramente no preparo pós-operatório de pacientes submetidos a operações intestinais depois do preparo do intestino com neomicina.

4. O intestino é esterilizado das bactérias aérobias com o preparo de 24 horas pela neomicina antes da operação e, em média, cinco e meio dias no pós-operatório. Esta esterlização poderá ser mantida por três a dez dias.

5. O uso pós-operatório da penicilina e estreptomicina não aumenta a média de duração da esterilização intestinal, e pode interferir no retôrno da flora.

6. A hospitalização pré-operatória é diminuida pelo emprêgo da neomicina durante 24 horas.

## ZUSAMMENFASSUNG

1. Neomycin ist ein ausreichendes Hilfsmittel zur Vorbereitung des Darmes für operative Eingriffe.

2. Die Wirkung des Neomycin führt nicht zu einer mechanischen, d.h. auf Verflüssigung des Stuhles beruhenden Vorbereitung des Darmes.

3. Kranke, die vor einer Darmoperation mit Neomycin vorbereitet worden sind, sollen nach dem Eingriff nicht routinemässig mit Antibiotika behandelt werden.

4. Nach 24-stündiger Vorbehandlung mit Neomycin ist der Darm am Tage des Eingriffs frei von aëroben Bakterien und bleibt durchschnittlich fünfeinhalb Tage nach der Operation steril; dieser Zustand kann aber drei bis zehn Tage lang bestehen bleiben.

5. Die Verabreichung von Penicillin und Streptomycin verlängert nicht die Dauer der Sterilität des Darmes, kann aber einen störenden Einfluss auf die Rückkehr der normalen Flora ausüben.

6. Durch Anwendung der 24-stündigen Darmvorbereitung mit Neomycin lässt sich die Dauer des Krankenhausaufenthaltes vor der Operation abkürzen.

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> Be very wary of opinions that flatter your self-esteem. Both men and women, nine times out of ten, are firmly convinced of the superior excellence of their own sex. There is abundant evidence on both sides. If you are a man, you can point out that most poets and men of science are male; if you are a woman, you can retort that so are most criminals.
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> —*Russell*

# Treatment of Anorectal Fistulas

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THE problem of fistula-in-ano is primarily one of eradicating the fistula in a single operation without destroying the continence of the sphincter ani.

*Etiology and Diagnosis.*—The cause of the ordinary fistula is known to all and will not be described in detail here except to note briefly that it results from infection beginning usually in the preformed anal ducts located in the anal crypts, or sometimes in an anal ulcer. The infection thus started burrows by one or more of several routes into the surrounding tissues, forming an abscess that ruptures or is incised surgically, and a fistula is born. Textbooks to the contrary notwithstanding, tuberculous fistulas are rare, as are fistulas with high internal openings in the rectum above the anorectal muscle ring. However, it is well established that longstanding fistulas may develop into malignant tumors, and this alone is sufficient reason for eradication of the lesion. It should also be kept in mind that actinomycosis and tuberculosis, although uncommon, may be present. Fistulas with high rectal openings are almost invariably due either to trauma or to intraluminal incision of an abscess erroneously thought to be submucous.

Detection of the presence of a fistula is unlikely to tax the diagnostic acumen of the surgeon. However, determination of the actual tract and its ramifications, as well as the exact location of the internal (or primary) opening often presents difficulty.

*Methods of Finding Internal Opening.*—There are several rules of thumb based on the location of the external opening which may lead the surgeon to certain suspicions. These rules may be enumerated as follows:

1. When the external opening is within 1 cm. of the anal verge the tract usually does not undermine the subcutaneous external sphincter but often does have a blind submucous extension above its internal opening at the anorectal line.
2. When the external opening is large, irregular, and has undermined edges, tuberculosis may be suspected.
3. An external opening surmounted by a sizable tuft of granulation tissue is likely to indicate a deeply situated tract.
4. The presence of a number of external openings usually, though not invariably, indicates several branches of a single tract with a single internal opening.
5. An external opening 1 or 2 cm. lateral to the tip of the coccyx may indicate a retrorectal sinus.
6. The presence of two external openings, located more or less symmetrically one on each side, often indicates a horseshoe fistula with a single internal opening in the posterior commissure even if one of the openings is located in an anterior perianal quadrant.
7. Finally, there is Goodsall's rule with which most surgeons are familiar and which states that an external opening located posterior to a line drawn transversely through the anus indicates a curved tract with the internal opening in the posterior commissure, whereas an opening anterior to this lin [illegible]es a superficial

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straight tract proceeding radially into the anus.

Let me emphasize that none of these indications is to be taken as more than a clue.

Since the eradication of a fistula requires also the elimination of the source, which is to say the internal or primary opening, the exact location of the latter becomes a matter of prime importance. This is not always easy. Several methods are available. In the first place, since most primary openings are located in the anal canal at or below the anorectal line, it becomes imperative first of all to visualize that area with a suitable anoscope, good illumination and a suitable crypt hook. Many such hooks are on the market, although my personal preference is for a thin probe with its distal ¼ inch (0.6 cm.) bent at an angle of 60 degrees. The crypts are visualized and explored, as is the lining of the anal canal distal to the crypts. Many an obvious internal opening has been missed, in spite of careful search, because it was low in the anal canal.

Careful palpation of the perianal tissues will often reveal a cordlike induration representing the tract and leading the finger toward its intra-anal terminal.

The use of such dyes as methylene blue at the time of operation is in most cases unnecessary and often results in a dense staining of the entire field that obscures more than it reveals.

In dealing with deep and complicated fistulas, it is occasionally useful to inject the tract with warm Beck's paste or lipiodol and then to take stereoscopic roentgenograms of the area. In such a case it is essential to remove carefully all of the radiopaque substance from the skin to avoid a misleading picture.

At the time of operation it is often useful to visualize the suspected portion of the anal canal and anorectal line with a suitable speculum. Traction with an Allis clamp on the external opening may then produce a visible dimpling at the site of the internal opening.

*Treatment.*—Surgical cure of the fistula is theoretically simple and consists merely in converting the tunnel into an open gutter, removing all or as much as possible of the diseased tissue. All surgical treatment of anorectal fistula is based upon this principle. This means that *all* tissue overlying the tract must be incised, including whatever muscle may intervene between the tract and the surface of the skin. In addition, enough surrounding uninvolved tissue must be removed to provide adequate drainage, and this drainage must be maintained by painstaking postoperative care. With a simple, straight, superficial tract this is comparatively easy.

To describe, however, an operation on a deep curved posterior fistula with several external openings: Owing to the tortuous route of the tract in such a case it will probably not be possible to pass a probe directly from the external to the internal opening. Instead, the probe is inserted in one external opening and the overlying tissue incised, after which the probe is reinserted in a new direction. This process is continued until all tracts are completely laid open to and through the exact internal opening. In the process it will undoubtedly be necessary to incise considerable portions of the sphincter musculature. It should be emphasized that even if a large amount of muscle extends between the tract and the skin surface it must all be cut if the fistula is to be cured. In some cases it may be advisable to do this in two stages, incising the majority of the muscle bundle in the first stage, securing the remaining muscle with a seton as a marker, and incising the remaining muscle later, after the first incision has healed. Fortunately this is not always necessary, as the presence of even a small amount of intact puborectalis will ordinarily insure adequate continence.

Occasionally the surgeon may be disconcerted to find, on inserting a probe in the external fistulous opening, that the instrument proceeds for 3 or 4 inches (7.6 to 10.1 cm.) in a straight cephalad direction, with no tendency to turn toward the anus. In the great majority of such cases a side branch will be found extending to an internal opening in one of the usual locations. The problem immediately arises, however, of providing proper drainage for the deep end of this sinus-like tract. This problem is solved by first removing all horizontal tracts and the internal opening in the manner previously described. An incision is then made from the depth of the vertical tract directly posteriorly toward the coccyx. If necessary, the sacrotuberous ligament and the gluteus maximus may be partially divided. After excision of surrounding skin and fat in order to "saucerize" the wound, a sizable defect is left. However, by this means adequate drainage is provided, and it is well to remember that postoperative difficulties after fistula operations result mostly from wounds which are too small rather than from those which are large.

Although fistulectomy wounds will heal more quickly and with less trouble if the entire tract wall is removed, it is sometimes advisable to leave a small portion of the deep wall where a large amount of sphincter has been divided. The portion thus left is that part which passes through the muscle, and it is permitted to remain in order to prevent, by its fibrous attachment to the muscle on each side, too great a retraction of the muscle ends. In such a case, however, it is essential thoroughly to remove all granulation tissue by means of a curet and to take especial care during the postoperative period to prevent bridging and pocketing of the site.

*Pitfalls and Complications.*—With the exception of incontinence, complications of fistulectomy are nearly all due to inadequate operation. In particular, the following points are stressed:

1. It is essential to find and eradicate the internal opening. There is no substitute for this, and the expert surgeon will almost always succeed in doing so. In the occasional case, however, in which the tract can be traced to a point immediately below the anorectal line but an actual opening is not found, the entire anorectal line, including all crypts for at least 1 cm. on each side of the probable site of the opening, must be excised.

2. All of the tracts should be removed; if for some reason this is not done, the remaining tract wall should be so thoroughly curetted that practically no fibrous tissue remains.

3. Wide external drainage is essential, and in this respect the surgeon must ruthlessly sacrifice any uninvolved skin and subcutaneous tissue that tends to obstruct drainage. This may leave a very large wound, but such wounds, if properly "saucerized" and cared for, will heal faster and remain cleaner than smaller ones with more nearly vertical sides. It is almost always possible to create additional drainage by carrying the incision posteriorly as far as the coccyx if necessary.

4. It is often quite easy to overlook additional external branching tracts, and this is another cause of postoperative difficulty. When the entire main tract or tracts have been laid open, a careful search should be made for additional branches. One method is to explore carefully with the probe, taking care not to err in the other extreme by creating false passages. A useful maneuver is to remove granulation tissue by curetting. A small tuft of remaining granulation tissue, apparently immune to the curet, may prove to be the entrance to another branch.

*Postoperative Care.*—Fistulous wounds are ordinarily [illegible] but if [illegible] has been inserted it should be removed in twenty-four to thirty-six hours and not replaced. Sitz baths and routine anal hygiene are instituted on the day following operation. If adequate external drainage has been provided, the discharge should not be unduly purulent. When a relatively clean fistulous wound begins to show a drop or two of pure pus in its depths, a meticulous search should be made for a poorly draining pocket, which must be eliminated. Premature agglutination of the deeper sides of the wound, particularly that portion entering the anal canal, may be prevented by the frequent use of a small glass rod, the size of an ordinary cocktail stirrer. This maneuver is efficacious and causes minimal discomfort to the patient. Exuberant granulations should, of course, be treated with silver nitrate and the cutaneous edges kept free from hairs by means of shaving. If it is kept in mind that the wound must heal from below according to the basic principles of surgery, and if the disease has been removed and adequate drainage provided, the postoperative care, while prolonged, need not be difficult.

*Principles Regulating Division of the Sphincter.* — Questions commonly arise concerning the possibility that incontinence may follow division of the sphincter. In order safely to divide the muscle, the anatomy of the sphincteric mechanism must be thoroughly learned, and it must be realized that ordinary continence depends upon the various divisions of the external sphincter ani plus the puborectalis, rather than the internal sphincter. With these facts in mind, the following principles may be propounded:

1. The subcutaneous external sphincter may ordinarily be cut in one place with impunity except in the anterior commissure in the female. In many instances even this is safe.
2. The sphincter should be cut at right angles to the long axis of its fibers.
3. In well-muscled persons, especially in the posterior commissure, it is usually possible to sever almost the entire muscle, provided that a 1 cm. bundle of puborectalis is left intact. In these cases, however, there may be some difficulty in controlling gas if a cavernous cicatrix results.
4. Muscle ends should not be packed apart for more than twenty-four to thirty-six hours.
5. If muscle ends, when severed, tend to retract unduly, they may be partially approximated with loose figure-of-eight sutures. To approximate the ends completely would, of course, defeat the purpose for which they were cut.
6. If it is necessary to sever all or almost all of the muscle, the greater portion may be divided and the remainder surrounded by a loose seton. The undivided portion may then be safely divided at a later date, when the remainder of the muscle has healed.

## SUMMARY

The cause and diagnosis of fistula-in-ano are briefly discussed.

Methods of locating the internal fistulous opening are described, including use of the roentgen ray.

Surgical technic for eradication of a deep, curved, complicated fistula is described in detail, and the necessity of exact location of the internal opening, as well as for wide drainage, is emphasized. Postoperative care is described.

Six principles governing the division of the anal sphincter are enumerated.

## RESUMEN

Se discute brevemente la etiología y diagnóstico de la fístula anal. Se describen los métodos para hallar las fístulas internas, incluyendo el uso de los rayos X.

Se describe en detalle la técnica quirúr-

gica para la erradicación de la fístula profunda, curva, complicada, y la necesidad de la localización exacta de le abertura interna. Se señala el amplio drenaje y el cuidado postoperatorio.

Se enumeran los seis principios que gobiernan la división del esfínter anal.

### RIASSUNTO

Viene esposta brevemente l'etiologia e la diagnosi delle fistole anali, e vengono descritti i metodi per la dimostrazione degli sbocchi fistolosi interni, compresi quelli radiografici.

Viene descritta dettagliatamente la tecnica per l'asportazione chirurgica delle fistole profonde, curve, ramificate, per le quali è necessaria una localizzazione esatta dell'orificio. Viene trattata anche la terapia post-operatoria.

Se la tecnica è corretta non si hanno insuccessi nè complicazioni.

### RÉSUMÉ

Bref aperçu de l'étiologie et du diagnositc.

Méthodes permettant de dépister les fistules internes, y compris par les rayons X.

Description détaillée de l'extirpation d'une fistule profonde, sinueuse, au parcours compliqué. L'auteur souligne la nécessité de connaître l'endroit exact où s'ouvre le trajet interne et l'importance d'un large drainage. Soins opératoires.

Enumération de six régions permettant de diviser le sphincter anal.

### ZUSAMMENFASSUNG

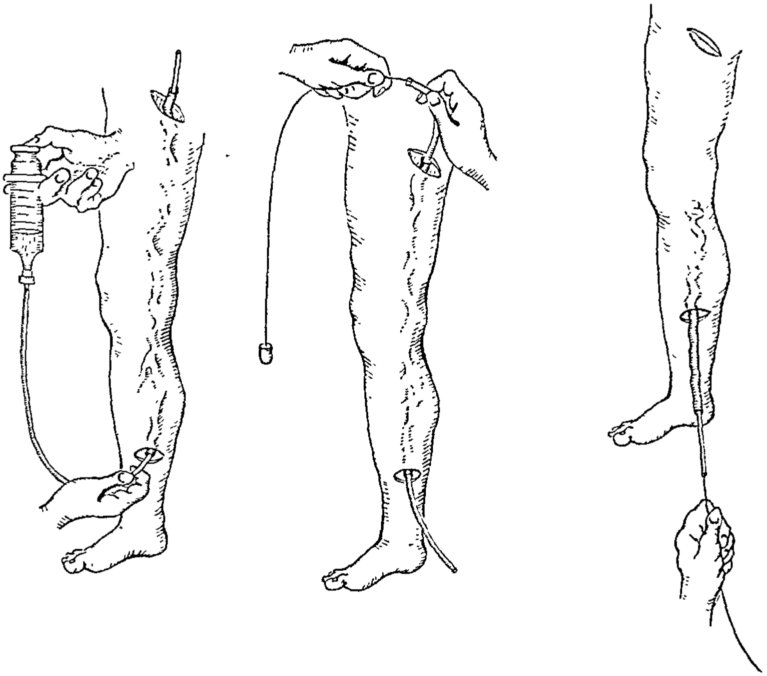
Die Aetiologie und Diagnostik der Analfisteln werden kurz erörtert.

Verfahren zur Auffindung der inneren Oeffnung der Fisteln einschliesslich der Röntgenuntersuchung werden beschrieben.

Die chirurgische Technik zur Ausräumung einer tiefen gewundenen komplizierten Fistel wird in ihren Einzelheiten beschrieben, und die Notwendigkeit genauer Lokalisation der inneren Oeffnung und die Bedeutung umfangreicher Drainierung wird hervorgehoben. Die postoperative Nachbehandlung wird beschrieben.

Sechs Grundsätze werden aufgezählt, die bei der Präparierung des Schliessmuskels des Afters eine Rolle spielen.

> It is awful to think that this world in which so many poets have praised has even for a time been depicted as a mantrap into which we may just have the manhood to jump. Think of all those ages through which men have had the courage to die, and then remember that we have actually fallen to talking about having courage to live.
>
> —*Chesterton*



*Left*, insertion of catheter into saphenous vein, from below upward. *Center*, obturator passed from above downward through catheter. *Right*, obturator with bullet strips the vein.

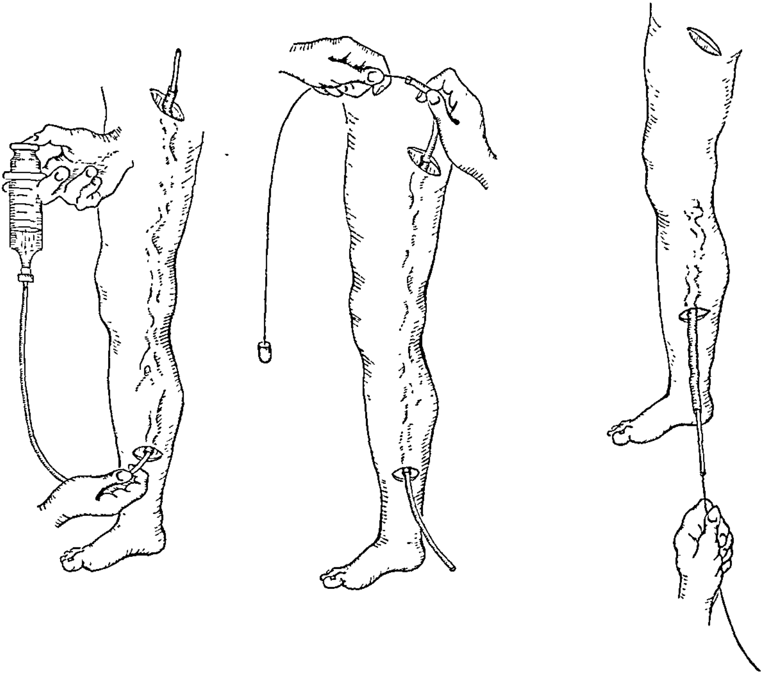
RÉSUMÉ

L'auteur décrit un nouvel instrument très simple qui s'introduit tout le long de la veine saphène et qui permet, en la retroussant, de l'extirper sans pratiquer d'incisions. Grâce à ce procédé l'auteur a toujours obtenu de bons résultats, sauf dans deux cas où l'opération fut suivie d'un état fébrile.

RIASSUNTO

Viene descritto un semplice strumento per strappare le vene, che viene introdotto lungo tutta la safena, senza incisioni.

Tranne in due casi, in cui vi fu febbre dopo l'intervento, l'autore ha sempre avuto degli eccellenti risultati.



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# A Hydraulic Vein Stripper

HERBERT D. TRACE, M.D., F.I.C.S.[*]
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HOW many surgeons have sweated over timely multiple incisions when operating on varicose veins? The intraluminal stripper was designed to obviate those multiple ugly incisions. In roughly 50 per cent of the cases it has not succeeded; i.e., the stripper was blocked before it traversed the entire saphenous vein.

A change in design of the intraluminal stripper enables one to avoid most of this difficulty. Anyone who has catheterized the heart knows that the cardiac catheter passes quite easily up the veins to the heart while, simultaneously, saline solution distends the vein. Anyone who has examined a collapsed rectum by proctoscope knows that its distention with a few puffs of air will permit the proctoscope to pass up the lumen readily. Yet intraluminal strippers on the market today are forced through collapsed saphenous veins.

I have used a No. 7 cardiac catheter passed from below upward in the saphenous vein. Fifty cc. of saline solution is injected slowly as the catheter is passed. Then, because the cardiac catheter has no tensile strength, a wire is passed from above downward through the catheter. The end of the wire has a bullet which strips the vein.[**]

*Results.*—In every one of 7 consecutive patients in whom twelve greater saphenous veins were stripped, the stripper passed all the way. In no case did the stripper lodge in the region below the knee, as so frequently happens with the old type of stripper.

In 2 of these cases a febrile course ensued. The first patient had chills as soon as she left the operating room. Since the treatment of these 2 patients, however, and with scrupulous aseptic technic, there have been no more febrile responses.

## SUMMARY

*A simple new vein stripper is described* which passes easily up the entire saphenous vein without the necessity of intervening incisions. Except in 2 early cases, in which a febrile course followed the operation, the author has obtained excellent results with this device.

## ZUSAMMENFASSUNG

Es wird ein neues Instrument zur Venenextirpation beschrieben, mit dessen Hilfe sich die ganze V. saphena ohne die Notwendigkeit weiterer Einschnitte leicht herausziehen lässt. Ausser zwei Fällen im Anfang, die nach der Operation einen fieberhaften Verlauf hatten, sind die vom Verfasser erzielten Resultate ausgezeichnet.

## RESUMEN

Se describe un nuevo desgarrador venoso que pasa facilmente a través de toda la safena sin necesidad de incisiones. Excepto en 2 casos, en los cuales se presentó un período febril postoperatorio, el autor ha obtenido excelentes resultados.

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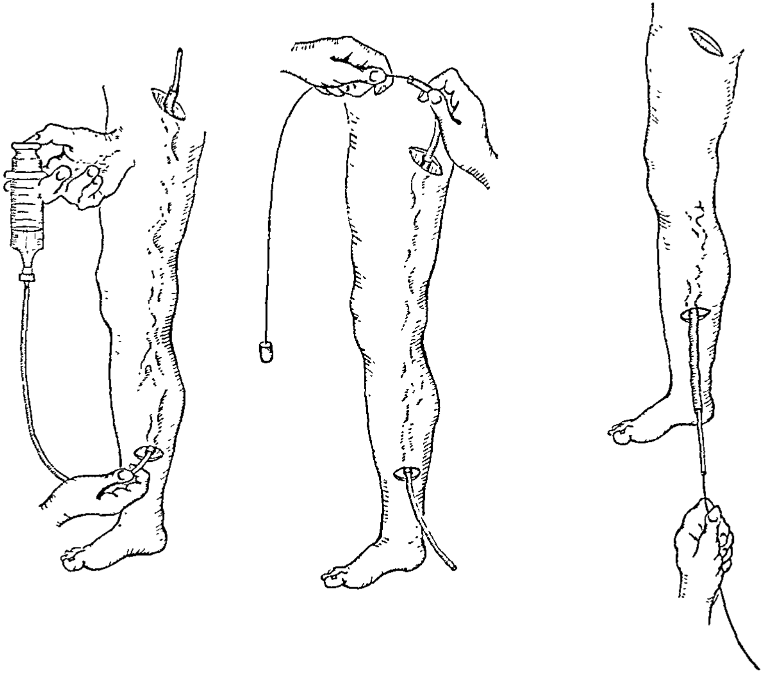
[*] Cardiac Surgeon, American Hospital, and Adjunct in Surgery, Mount Sinai Hospital, Chicago.

[**] This vein stripper is manufactured by Grieshaber Mfg. Co., [illegible] Armitage, Chicago, Illinois.

Submitted for publication June [illegible], 1954.



*Left,* insertion of catheter into saphenous vein, from below upward. *Center,* obturator passed from above downward through catheter. *Right,* obturator with bullet strips the vein.

### RÉSUMÉ

L'auteur décrit un nouvel instrument très simple qui s'introduit tout le long de la veine saphène et qui permet, en la retroussant, de l'extirper sans pratiquer d'incisions. Grâce à ce procédé l'auteur a toujours obtenu de bons résultats, sauf dans deux cas où l'opération fut suivie d'un état fébrile.

### RIASSUNTO

Viene descritto un semplice strumento per strappare le vene, che viene introdotto lungo tutta la safena, senza incisioni.

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# Section on Ophthalmology and Otorhinolaryngology

PAUL C. CRAIG, M.D., F.A.C.S., F.I.C.S., EDITOR

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# Indications for Eye Surgery

## Physiologic Bases

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EVER since diseases of the eye were first recognized, the indications for surgical treatment have been paramount problems. At present they are still paramount problems, but they may be resolved when the indications are based on physiologic concepts, since this will provide an approach to uniform criteria. Uniform criteria, understood by all, will not only strengthen the ophthalmologists' prestige but more importantly, will help in the world-wide endeavor to prevent blindness. In their quest for the indicated therapy for ocular maladies, patients and even physicians are often confused by the varying and sometimes diametrically opposed advice of the several specialists. With criteria more nearly uniform, they will be given more consistent advice.

The following observations are based on my own judgment as to surgical intervention, a judgment founded on experience. Some of my readers may have had experiences that would alter the conclusions set forth in this report, but it is only by pooling of their experience that surgeons can finally arrive at the best basic criteria for surgical decisions.

Although the question of the time to operate is a moot point, the sole physiologic criterion is threatened or an actual loss of vision. Fundamentally operation should be performed only when the condition is potentially surgical and medical treatment has failed to control or improve it, or when medical therapy presents a greater hazard to vision than does the proposed operation. Each patient must be individually studied.

Age is of no definite concern in the decision to operate; ocular operations can be performed at any time from the first week of life to the last. Nor is hypertensive vascular disease a bar to surgical intervention. Though the internist may prefer to have the hypertension reduced preoperatively, his treatment should not necessarily delay an operation; even abnormally high blood pressure is of secondary significance. Dr. John Wheeler came to that conclusion years ago and my similar experience leads me to concur.

The same rule may be followed with other systemic diseases. Syphilis is present in a comparatively high percentage of inmates at Sing Sing Prison Hospital. During and after my operations on the eye, I have never observed any complication attributable to syphilis.

*These same observations have been*

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Read at the Congress of the Pan-American Ophthalmological Association, January 1952, at a meeting of the Wilkes-Barre Ophthalmological Association, January 1953, at a meeting of the British Medical Association, Caribbean Branch, September 1952, and at the Eighteenth Annual Congress of the United States and Canadian Sections, International College of Surgeons, New York, Sept. 13-17, 1953.

Submitted for publication Nov. 19, 1953.

made on tuberculous patients. With regard to diabetes, the state of hyperglycemia need not determine the time to operate. Some excessive bleeding may be anticipated, but this complication can be well controlled; if the hemorrhage is intraocular it usually clears spontaneously without complication. Despite the fact that the new antibiotics have radically reduced the incidence of serious ocular infection, it is inadvisable to operate in the presence of local disease, except for the specific purpose of curing the focus of infection.

Concerning smears and the punctilious preparation of the patient for operation there are two schools of thought. A simple preoperative preparation is favored. A mild silver protein is prescribed for two days prior to surgical intervention. Parenteral procaine penicillin is routine. No conjunctival smears are taken; thus no pathogenic organisms are encountered which contraindicate the procedure. Clinical appraisal is sufficient. Except in cases of cataract extraction, no preoperative enema is ordered. When the patient is on the table, alcohol only is applied to sterilize the skin and cilia, while the conjunctiva is irrigated with boric or saline solution.

Let us now examine the several conditions for the specific pathologic criteria which will indicate surgical intervention.

*Cataract.*—The definition of cataract, opacity of the lens, is in need of clarification. Scientifically, it has been my experience that the corneal microscope reveals a cataract in every person, child and man alike; no lens checked was ever completely clear. In the normal eye the "cataract" does not impair sight. In the clinically cataractous eye, however, there is interference with vision.

Since surgical therapy offers the only means of improving this vision, the time to operate is of primary concern to the patient, his physician and the ophthalmic surgeon. There are still differences of opinion as to the time, for the most appropriate time depends on the particular patient. Basically, however, the time to operate is when the vision of the patient is embarrassed, when he no longer can carry on his daily routine because of the cataract. A person in need of high visual acuity will be ready for operation with a vision of 20/40 (comparatively good eyesight for the majority of persons), whereas a housewife or a day laborer may be more than content and efficient at work with 20/200 or 20/100 vision—practically the equivalent of industrial blindness.

Apart from the actual loss of sight, there are occasions when it may be necessary to operate to offset the emotional disturbance attendant upon the patient's knowledge that he has a cataract. Although it is often said that it is essential to wait for the maturity of a lens opacity, many opacities, especially those of the nuclear type, never ripen. A case in point is that of an active, energetic, successful business man 71 years of age with bilateral cataracts. For twenty years he had been suffering from a marked loss of vision due to lens changes. He had been repeatedly advised to wait until the opacities ripened. Examination revealed nuclear sclerosis, a type of cataract that usually never ripens. Operation was decided upon because of the visual loss. After the date had been set for the cataract extractions, cardiac failure developed and the patient died before the operations. Early removal of the lenses would have given this man twenty years of normal sight instead of the twilight of partial blindness. This case well illustrates the fallacy of waiting for the maturation of cataracts.

Occasionally one encounters low grade iritis associated with an advanced, complicated cataract. If strict elimination of foci of infection—and really strict—does not cure the iritis, it is suggested that lens extraction be considered in order to clear the inflammation which may be an iritis phaco-anaphylactica. Postoperative healing is not interfered with by the presence of iritis.

A cataract complicated by glaucoma is always a problem. Although some ophthalmologists advise initial operation for glaucoma at all times, I do not share their opinion. When a cataract is complicated by glaucoma, both the cataract and the complicating hypertension may be cured by removal of the lens. If it is not, mild medical antiglaucomatous therapy is sufficient to keep the tension normal and the physiologic test results within bounds. Should the glaucoma persist uncontrolled, however, further operations can be performed at this later date.

*Glaucoma.*—In the New York area glaucoma is not the serious blinding disease of former years; blindness due to this cause now is infrequently observed. Improved nutrition may be one of the basic reasons, but improved care of the eye, earlier detection of the condition and operation soon after its onset are major contributing factors. Early operation should be emphasized. Early operation, when damage to the eye first becomes apparent, gives the patient the best chance for good recovery, with very good vision throughout his life. Chief consideration must be given to the primary type of glaucoma. The following observations are directed to this most frequent type—primary chronic simple glaucoma.

Once the diagnosis of glaucoma is established, it is well to prepare the patient psychologically for operation. In only a very small percentage of cases is operation unnecessary; in these exceptional cases the glaucomas either never progress or are controlled by medication. There may even be a rare cure; the results of physiologic tests and the tension become normal; subjective complaints disappear. In the large majority of cases, though, the condition does progress, and the patient, if operated on early, can have good vision throughout the years ahead. Early operation is far more dependable than the expectation that the patient will carry on a continuous course of necessary treatment. Early operation is visual insurance, and one should err, if at all, on the side of decisive action.

Glaucoma, when first observed in the advanced stage, with tubular vision, must be expected to progress still more and will cause blindness unless the hypertension is checked. Without question, despite the greater hazard, operation is to be advised. I have performed successful operations on such eyes, after which the patients retained their sight for years.

Abnormally high tension within the globe itself indicates the diagnosis of glaucoma. This increased tension usually is determined by the tonometer, which is taken as the standard means of measurement; the value of finger palpation is considered questionable. That, however, is not the case. In my hands, palpation of the globe has proved to be an important phase of every eye examination, glaucoma being discovered in the adult as well as in the child, quite often in cases in which the tonometer, checked for accuracy, gave a normal reading, and when no other suggestive sign was present. It may be mentioned that finger palpation for initial intra-ocular tension is more accurate qualitatively and that the result generally is higher than that obtained by the tonometer after the instillation of drops. The mere instillation of drops, with consequent closure of the lids, apparently acts in similar fashion to massage of the globe, with a resultant reduction in ocular tension. In the absence of raised pressure, the surgeon should not be deterred from operating when other tests prove the condition to be present. There are many glaucomatous eyes that never, on examination

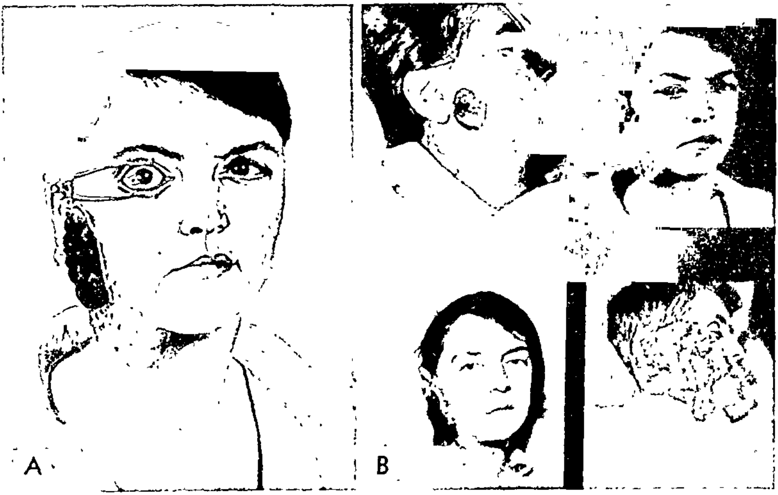

Fig. 1.—*A*, patient with parotid tumor and dermoid cyst in eye undergoing melanotic degeneration. *B*, parotid area after excision of melanoma and rapid subsequent growth of tumor. Last photograph taken two days before death. Autopsy revealed melanois cells in both ocular dermoid and parotid tumor.

by the oculist, reveal hypertension. Increased intraocular pressure in a given eye is that pressure which is too great for that particular globe and which therefore gives rise to loss of peripheral and/or central vision. Since such tension is relative and dependent upon the particular eye, it is an indeterminate normal prior to its establishment. Therefore, in the use of the tonometer, it is well to be guided by both these facts—apart from the inherent errors in the tonometer itself—that the tonometric reading is actually less than the true measure of the pressure exerted by the intra-ocular fluids upon the fibrous tunic and that abnormal pressure within the eye really depends upon the individual eye. Both of these facts point to the conclusion that many cases of glaucoma fall within the normal range of the tonometer; hence, other physiologic tests must reveal the diagnosis if the disease exists. Two very early signs of glaucoma may be emphasized, signs that have proved valuable: deepening or enlargement of the physiologic cup, with the vessels pushed to one side, and the Roenne step.

It is true that failing vision in a glaucomatous eye calls for surgical intervention, but only when the failing vision is caused by the hypertension. Retrobulbar neuritis can and does complicate a glaucomatous condition. It is a diagnosis to be borne in mind, a diagnosis which may make it unnecessary to operate. Likewise, the presence of chorioretinitis as the cause of the failing vision will obviate the need of intervention. Incidentally, a rehabilitating process, with particular attention to the strict elimination of foci of infection, especially the silent sinus, often will cure the neuritis promptly and arrest or cure the chorioretinitis in [illegible]tively short order.

After surgical intervention the glaucoma may continue to advance despite medical treatment; then a second or even a third operation is in order. Glaucomatous damage must be controlled if at all possible. One procedure usually suffices, but further operations may be undertaken safely without regard to the time lapse, except that an eye free from inflammation is preferred postoperatively.

*Strabismus.*—For the purpose of this discussion, strabismus will include both manifest and latent deviations of the eye.

Before resorting to surgical intervention, one should try all other possible means of correction. It is surprising sometimes to find the strabismus, the divergent or even the convergent, respond to medical therapy. Operation is to be advised only when the nonoperative measures have been evaluated and found wanting. The decision to operate must imply a reasonable chance for improvement of the symptoms. It is agreed that the best time to straighten eyes is before the age of 6; after that, it becomes increasingly difficult to keep the eyes straight and to maintain binocular single vision. The time to operate, however, will be determined by the surgeon's experience. In the case of strabismus, accommodative or paralytic, in which operation seems to offer the only means of cure, the age of the patient is not to be considered.

The improvement of vision in the manifestly "crossed" eye and the development of binocular single vision usually are of less importance than the primary aim of this operation—cure of the sense of inferiority accompanying the condition. On many occasions such an emotional complex may be very deeply rooted, as was a patient of mine, a young lady who, excepting for her tropia, is a very pretty girl. Since her eyes have been straightened her personality is completely changed. From an introvert she has become an extrovert. No more appreciative patient can be seen, particularly if she receives a proposal of marriage.

The inferiority complex, however, is not confined to the female. An outstanding surgeon in his early seventies recently came to the office for correction of a marked convergent strabismus of 42 degrees, present since childhood. After the operation he, too, was highly pleased, perhaps because he is married to a beautiful woman much younger than himself.

*Retinal Separation (Detachment).*—Separation of the retina is more frequently spontaneous than tramatic. There are occasions when the separation is due to a neoplasm, the result of ocular degeneration, or to some other complicating basic disease. The treatment in these instances will depend upon consideration of the problem as a whole. In cases without complications, cases in which there are no contraindicating factors and in which the retina may be replaced, operation offers the most generally accepted method of cure at present. But since there are instances of retinal detachment cured by palliative means, most patients may be immediately confined to bed, given medical treatment and observed for a number of days, without fear of complicating the operation if it becomes necessary.

It is of particular interest to speak of the recent medical cure of 4 out of 7 cases of spontaneous partial retinal separation, present from a few days to six months. Three of the cured conditions were bullous separations and one was flat. They were all given complete bed rest and salt-free diets plus mercuhydrin and ammonium chloride. The rice diet may be substituted for the salt-free. After this procedure, should reattachment not be a continuous process, then operation is to be performed, with the knowledge that, practically, there has been no interference with the final outcome of the procedure.

Since it is recognized that this very small number of eyes medically cured of detached retinas is really no index of the potential value of this treatment, it is suggested that this type of therapy be administered to many more patients in order to evaluate it properly.

In the event that the first operation is unsuccessful or that there is a recurrence of the condition, a second or even a third may be carried out. The time between operations will be gauged by the quiescent state of the eye and occasionally by the type of operation previously performed.

*Enucleation.*—Enucleation, as a rule, is to be advised in all cases of blind, painful eyes. Some of these globes will reveal intraocular growths. There are occasions, however, when an intraocular neoplasm is observed preoperatively; then enucleation or exenteration is to be recommended, enucleation for the intraocular growth and exenteration for the growth not confined to the globe. In a patient with bilateral retinoblastoma, one should attempt to preserve one eye.

Malignant growths on the lids, on the surface of the globe or localized within the iris may often be excised widely and the eyeball saved. Recently I have excised a pigmented tumor of the ciliary body and preserved the eye. Pathologic section of the growth revealed a benign melanoma.

To emphasize the fact that growth of the tumor is not necessary for the diagnosis of malignant disease or for the development of metastases, two slides may ve viewed. Figure 1*A* is a drawing of a twenty-six year old girl who complained of a recently observed parotid tumor. Because of a growth in the eye, a consultation was advised. The growth proved to be a dermoid cyst, within the center of which was a small brown area. I made a diagnosis of dermoid cyst undergoing melanotic degeneration. Figure 1*B* shows the parotid area after excision of the melanoma and the rapid subsequent growth, the last photograph having been taken two days before death. Autopsy revealed similar melanotic cells in both the ocular dermoid and the parotid tumor.

Since one can never positively differentiate the benign nevus from the malignant melanoma by clinical means, it is my general policy to excise external ocular pigmented nevi, especially if they are cosmetic blemishes.

When the possibility arises of seriously endangering a sound eye by sympathetic ophthalmia, enucleation should be considered. Removal of an eyeball, though, is never urgent. Any eye may change radically in a week after a severe injury, and signs of sympathetic irritation in the fellow eye are not to be construed as the onset of sympathetic ophthalmia. Sympathetic irritation is seen frequently; sympathetic ophthalmia is not.

It is also unnecessary to enucleate an eye directly after a perforation in the ciliary body region. I have several times seen cases in which this type of accident was complicated by prolapse of the ciliary body. On one occasion there was a second herniation of the ciliary body in the adjacent area of the same eye. The herniated tissue was always excised and the wound closed, and an uneventful recovery, with normal or good useful vision, was obtained in each case. No evidence of sympathetic ophthalmia has been observed up to the time of writing, twelve years having elapsed for the first 3 patients.

*Injuries to the Eye.*—Injuries to the orbit are self-indicative of the type of operation required. Since the orbits are so conspicuous, it is not surprising that the fine differences between them are noticeable. Therefore, careful repair of a wound is imperative. "Always overcorrect" is an e t rul

Although secondary suture may be of benefit in other parts of the body, primary closure of wounds of the orbit is in order. Repair of the tissues as soon as possible after the injury is suggested, since the traumatic reaction will present added difficulties. As a rule, foreign bodies in the orbit, but outside the globe, are not a cause for concern.

For accurate localization of a foreign body within the globe, roentgen films should be taken; also, when there is a question of an intra-ocular foreign body, roentgenograms are needed. Figure 2 shows the right orbit of a youngster who was shot in the eye with a BB gun. The shot is visible within the globe. On first examination, no wound of entrance could be found either in the lids, which were markedly swollen and discolored, or in the severely tramatized eye; nevertheless, roentgenograms were ordered and the child given palliative therapy. Later, the roentgen report revealed an intra-ocular circular metallic foreign body. On the boy's next visit to the office, a few days later, a more minute search was carried out for the perforation. Moderate traction was made on the still swollen lids; in this process, unavoidable pressure was exerted around the fornices so that as much of the globe as possible could be exposed for inspection. As the inferior central fornix was exposed, the BB shot popped out of the eye. Surrounding the shot as it emerged from within the eye was a yellowish mucoid material which continued posteriorly to form a tail for the shot. The eye had been saved.[1]

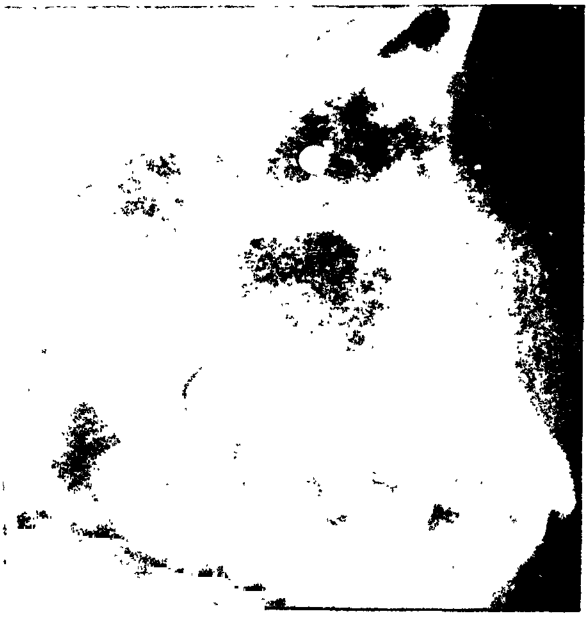

Fig. 2.—Right orbit of child shot with BB gun (see text).

From this experience, may I suggest that in the presence of an intra-ocular foreign body not attracted to a magnet, a similar procedure be resorted to? Place the patient in bed, his position varying with the location of the perforation to favor gravity; wait a couple of days, and then carefully express the globe, before attempting the dangerous intra-ocular instrumentation for removal. Success with this simple maneuver should save the eye.

*Myopia.*—Surgical treatment for high myopia has been advocated for years. Myopia, however, is only one symptom of a systemic disease—mesenchymal hypoplasia. In my published and unpublished reports concerning every type of myopia, including malignant myopia up to minus 41 diopters, I have never advised operation. On the contrary, I have prescribed sufficient calcium and sufficient vitamin D. Reduced myopia and improved vision in these "advanced cases" frequently takes place, regardless of age. Ample improvement should make it unnecessary to operate.

*Plastic Surgical Procedures.* — Prevention of plastic operations, of course, is the ideal. Congenital anomalies and developmental blemishes are unavoidable, but there is a large class of plastic operations that lends itself to prevention. Proper, immediate care of the injured orbit will prevent the need of much future plastic intervention.

Whenever a cosmetic blemish appears in the eyeball or lids, that is the time to operate, provided that the operation weighs in the patient's favor. Scar tissue is the cause of most cosmetic defects. Except for burns of the orbit, for which there may be a direct indication for a plastic procedure, it is generally well to delay operation for a recent defect resulting from trauma until the optimal state of healing has taken place. Whenever there is a choice of a graft for the correction of the disfigurement, I favor the free skin graft rather than the sliding type. Nontraumatic blemishes of the lids or globe may be corrected at the patient's request or at the surgeon's suggestion.

*Dacryocystitis.* — Acute dacryocystitis may be an indication for surgical treatment, but a chronic infection of the tear sac was formerly the indication. My most recent patients with the latter type of infection have been cured by penicillin drops and/or instillation of the drug into the lacrimal sac. After a trial of this therapy, without cure, operation can be performed.

*Corneal Opacity.* — Reduced vision and/or scarring may be the indication for surgical intervention for a corneal opacity. Prior to any corneal operation it is necessary for the opacity to have reached its optimally healed state; all vascularization of the membrane must be absent to insure success. In the presence of a partial corneal opacity, not involving the whole corneal area but entirely covering the pupil and thus reducing vision, the indicated surgical procedure is corneal tattooing followed by an optical iridectomy. The two procedures may be done simultaneously. Regularly I advise this procedure rather than use of the much less successful corneal graft. Tattooing and iridectomy will in no way jeopardize the results of a later transplant, should such an operation ever be deemed advisable.

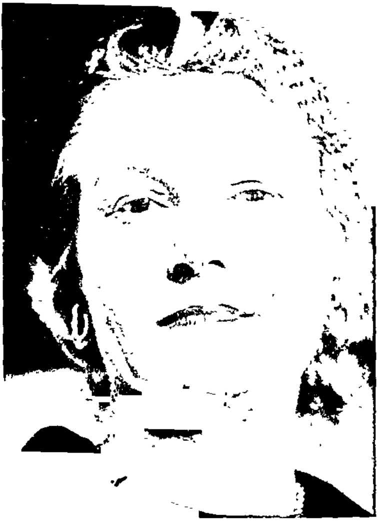

Fig. 3.—Patient treated by tattooing with iridectomy fourteen years prior to time of writing; 20/20 vision resulted, and the tattooing remained effective.

If the opacity only partially occludes the pupillary area, the remaining transparent cornea anterior to the pupil will still permit good vision. Iridectomy is unnecessary in such an eye. Tattooing, however, will serve the dual purpose of enhancing the appearance and improving the vision. The pupil after the corneal tattooing permits this improved vision because it gets the effect of a pinpoint diaphragm, which pinpoint opening in an opaque material, placed before the eye, practically always improves vision.

If the scarring of the cornea is a cosmetic blemish outside the pupillary zone, tattooing will cure the blemish. According to the background of the defect, the cornea may be colored black, blue or brown.

Two or even three tints, if indicated, may be applied at the same sitting.

Tattooing with iridectomy is safe, simple, permanent and devoid of late complications. Tattooing has been effective for over eighteen years. Figure 3 shows a young lady who had a tattooing with iridectomy performed in her right eye fourteen years ago; 20/20 vision resulted, and the tattooing remains effective.

This case also illustrates the fact that 20/20 vision is to be expected with any eccentrically placed pupil so long as all other structures in the globe are normal and the cornea anterior to the proposed pupillary opening is clear. The iridectomy resulting in the new pupil may be nasal, temporal, superior or inferior to the normal pupil. Normal vision may be anticipated.

## CONCLUSION

The actual time for operation in the presence of the several conditions discussed is a matter that must be determined by the surgeon on the basis of the individual case, always with due consideration of the expected result of medical treatment. Underlying the decision, however, there is but one simple rule: The time for ophthalmic surgical intervention is the time when vision is threatened or actually lost.

## SCHLUSSFOLGERUNGEN

Der angemessene Zeitpunkt zum operativen Eingriff bei verschiedenen in der vorliegenden Arbeit erörterten Augenerkrankungen muss vom Chirurgen je nach der Lage des Einzelfalles und immer unter Berücksichtigung der Möglichkeiten medizinischer Behandlung bestimmt werden. Es gibt aber nur ein Gesetz, des dieser Entscheidung zugrunde liegt, und das ist: der Zeitpunkt für einen chirurgischen Eingriff im Auge ist gekommen, wenn die Sehfähigkeit bedroht oder verloren ist.

## CONCLUSIONES

El tiempo de operación en presencia de los diversos padecimientos es un asunto que debe determinarse por el cirujano sobre la base del caso individual considerando siempre el resultado esperado del tratamiento médico. Sin embargo la decisión está en una regla sencilla: El tiempo de la operación oftálmica es el tiempo en que la visión se amenaza ó se pierde.

## CONCLUSIONI

La scelta del momento adatto per l'intervento deve essere fatta dal chirurgo caso per caso, vagliando debitamente i risultati della terapia medica.

Vi è, tuttavia, una regola semplice: si deve intervenire quando la vista è indebolita o quasi perduta.

## RÉSUMÉ

Le chirurgien, après un traitement conservateur précis, déterminera le moment opportun d'une opération suivant chaque cas particulier. Ce moment opportun pour une intervention chirurgicale ophtalmique sera appliqué au moment où la vision est menacée ou lorsqu'elle est déjà perdue.

## REFERENCE

1. Knapp, A. A.: Simple Removal of Intra-Ocular Foreign Bodies, J.A.M.A., 148:119 (Jan. 12) 1952.

(This statement has just been corroborated at a recent world-wide meeting of ophthalmologists held in Montreal, Canada, in August, 1954. The upper normal limit of the tonometer reading has been found too high, and therefore it has been reduced.)

# *Editorial*

## A New International Service

THE International College of Surgeons, which from the day of its founding has been constantly alert to the needs of surgeons the world over, remains mindful of both its debt to the past and its responsibility to the future. As is now well and widely known, the College is making a signal acknowledgment of the former by establishing the International Surgeons' Hall of Fame. We are now prepared to announce the filling of another long-felt need: the need for an INTERNATIONAL SURGICAL FILM LIBRARY.

The advantages of such a service are obvious. On all levels of education, nowadays, the use of audiovisual aids is steadily increasing. The foresight of the American Medical Association has made such facilities available to surgeons here at home. We consider it our natural responsibility, as an organization devoted to science—*without geographic boundaries*—to set about making them available to our members abroad.

At its most recent meeting the Board of Trustees of the College, putting into initiatory action this long-planned addition to the College program, requested that Dr. Philip Thorek be asked to assume the duties of Director of the Surgical Film Library. Dr. Thorek's work on the Film Forums presented each year at the Annual Congress of the United States and Canadian Sections, is well known and has been much appreciated—not only in the United States, since each year's Congress brings many participants and guests from abroad. In the united opinion of the Board of Trustees, he was unquestionably the first choice for this interesting but onerous position.

After due consideration, he accepted the post without remuneration.

As the project grows and facilities are set up, the widest possible distribution of the best professional films will be available to our members. As someone has wisely said, "One picture is worth ten thousand words" when it comes to clear and instant communication. It will be the endeavor of the International Surgical Film Library to make these films easily accessible wherever the need is felt.

Another aspect of this new department of work is of paramount importance; it cannot fail to help in the cementing of international friendships, since it represents a form of genuine intercommunication with our colleagues abroad—a prolongation throughout the year, so to speak, of the warm, delightful and rewarding international contacts now largely confined to the few days of each year in our busy lives and theirs when a Congress here or elsewhere affords us the opportunity to come together. Anything that increases communication between the College and its member Sections, anything that keeps each member constantly aware of his fellow members and the collaborative nature of our work, wherever we live and perform it, is matter for rejoicing. Since one of the [illegible] the International College [illegible] and create good will among men of science, we take the utmost pleasure in the opening of still another new channel of cultural exchange. The growth of the College has been so rapid that the scope of its activities must inevitably widen more and more as time goes on. It is evidence of the soundness and vitality of College ideals that they are being quietly but steadily realized, one by one. Probably we shall not realize them all; life is too short; but those who come after us will find the foundations well laid.

M. T.

Superstitions are not always dark and cruel; often they add to the gaiety of life . . . received once a communication from the god Osiris, giving me his telephone number; he lived, at that time, in a suburb of Boston. Although I did not enroll myself among his worshipers, his letter gave me pleasure . . . like also the men who study the Great Pyramid, with a view to deciphering its mystical lore. Many great books have been written on this subject, some of which have been presented to me by their authors. It is a singular fact that the Great Pyramid always predicts the history of the world accurately up to the date of publication of the book in question, but after that date it becomes less reliable. Generally the author expects, very soon, wars in Egypt, followed by Armageddon and the coming of Antichrist, but by this time so many people have been recognized as Antichrist that the reader is reluctantly driven to skepticism.

I admire especially a certain prophetess who lived beside a like in northern New York State about the year 1820. She announced to her numerous followers that she possessed the power of walking on water, and that she proposed to do so at 11 o'clock on a certain morning. At the stated time, the faithful assembled in their thousands beside the lake. She spoke to them saying: "Are you all entirely persuaded that I can walk on water?" With one voice they replied: "We are." "In that case," she announced, "there is no need for me to do so." And they all went home much edified.

—*Russell*

The Thyroid. By T. Levitt, M.A., F.R.C.S., F.R.C.S.E. Edinburgh and London: E. & S. Livingstone, Ltd., 1954. Pp. 606.

Mr. Levitt has written an outstanding book on the thyroid gland.

To produce such a work was a most courageous undertaking. One needs only to read the first few pages to understand thoroughly that the author is not a conformist. This stimulating tome is the result of twenty-five years of personal study. He discusses his own theories and provides a basis for an understanding of them.

He is of the opinion that the effect of the physiologic stress and strain to which this gland is subjected is mirrored by definite histologic as well as clinical phenomena. This corresponds to similar changes in other endocrine organs, occurring in a specific pattern that continues from birth to death.

Many have accepted the workable classification recommended for descriptive purposes by the American Goiter Association: toxic and nontoxic, diffuse and nodular goiter. Mr. Levitt goes beyond this and presents a physiologic treatise, in which he describes six progressive stages:

1. Epithelial hyperplasia
2. Lympho-epithelial hyperplasia
3. Focal lymphoid hyperplasia
4. Diffuse lymphoid hyperplasia
5. Fibrolymphoid hyperplasia
6. Fibrosis.

In his opinion, since epithelial tissue is the most common constituent of the normal gland, it provides an accurate index of the pathologic state of this structure. To this he adds the role of fibrosis, which occurs as a terminal event in the history of the gland. Between these two extremes is discussed the relation of lymphoid tissue to the subject in hand. This portion of the work is highly interesting and thought-provoking.

Mr. Levitt discusses the theoretic and philosophic phases of thyroid disease as well as the more recent aspects of modern therapy with radio-active substances. The way in which the material is presented indicates that the author must be an excellent teacher.

The illustrations and text depicting thyroidectomy call for special commendation.

This all-inclusive work has over 500 photographs and plates, 60 of them beautifully reproduced in color. Also of interest is the presentation in English of the contributions of Hashimoto and Riedel.

This book can be recommended highly to anyone interested in diseases of the thyroid gland.

PHILIP THOREK, M.D.

Resistance et Soumission en Physio-biologie: L'hibernation Artificielle. By H. Laborit. Paris: Masson et Cie., 1954. Pp. 120. Charts.

To those familiar with the French spirit of logic in things scientific, the present offering will come not as a surprise but as an expected and refreshing addition to the life of learning. Nor is it surprising that Dr. Laborit, surgeon and medical investigator, should so expertly vault the bars of his profession to instruct the public at large. This he has achieved with address and brilliance, in keeping with still another Gallic tradition.

Both popular and technical presses in all the leading languages have borne witness to the achievements and challenges of artificial hibernation in surgery. Though the method is in its infancy, Laborit observes that certain reports have already yielded results of statistical significance. Thus, the subject seems "made" for this new series on the evolution of science.

It seems that the series is also "made" for Dr. Laborit. Rapidly and colorfully he sketches the biologic concepts underlying latter-day discoveries — concepts of metabolism, defense and submission, *milieu interieur,* homeostasis, aging, disease and death. Modifying Claude Bernard's "constancy of the internal humoral environment," he asserts that the important controlling factor is the maintenance of constancy in the intensity of the vital processes. On this basis, he explains, the therapeutic need is a method of the slowing down and diminishing of these processes. The first step is pharmacologic inhibition of the system of intercellular and interorganic regulation — the stage termed "neuroplegia." This is followed by artificial reduction of the body heat (hypothermy) with concomitant metabolic depression. Under these conditions the organism can undergo more or less drastic procedures without the usual disordered and disorganizing response to surgical affront.

Here also is outlined some of the experimental work on which this procedure was based, as well as views on psychosomatic symptoms and the relation of man to society.

This book will be relished by those for whom medicine and surgery are still aspects of the great problems of general biology. A fuller technical discussion of artificial hibernation can be found in the author's *Pratique de Hibernotherapie* (1954) issued by the same publisher.

MAX THOREK, M.D.

**Peptic Ulcer.** By C. F. W. Illingworth. Edinburgh and London: E. & S. Livingstone, Ltd., 1953. Pp. 287. Illustrated.

The literature on peptic ulcer, already immense, is constantly increasing, both on the surgical and on the medical side. The current form of therapy is not the final one, even though cures are achieved in some cases. The surgical remedy, in particular, owes its importance to lack of a proper specific. It is clear from this situation that constant review of the disease and its treatment is needed. Many such reviews, written by men of authority, are available.

The present monograph, by the Regius Professor of Surgery at Glasgow, is one of the clearest and most distinguished in the field. Its importance is due to its rounded and complete presentation, the many years of clinical research represented, its extensive review of the literature and some heretofore unpublished data from the author's clinic.

Dr. Illingworth states at the outset that he writes not merely as a surgeon but as a student of disease. Consequently the surgical approach is but one facet of a many-sided problem. The book will therefore prove valuable to surgeon, physician, teacher and student alike. Its contents include the physiologic and pathologic pictures, the results of experimental research, the etiologic factors, the clinical picture, treatment from the psychosomatic, medical and surgical points of view, and complications. The study is completed with chapters on the ulcer-cancer problem, peptic ulcer of the esophagus, and peptic ulcer of Meckel's diverticulum.

In the chapter on surgical treatment, the comments on preoperative and postoperative care are drawn from the author's own experience. The operations discussed are gastrojejunostomy, vagotomy and partial gastrectomy. The author's own technic of partial gastrectomy is described in detail, with illustrations. In the Glasgow clinic, it is stated, "three different methods, anterior Polya, posterior Polya, and posterior Hofmeister are in regular use by different members of the staff, with results which are quite indistinguishable." Concerning the amount resected, the author, while recognizing the advantages of subtotal gastrectomy, writes as follows: "Certainly the experience of many surgeons in every part of the world shows that resection which, while extensive, falls far short of being subtotal carries only a small risk of secondary ulcer, and this risk is more than balanced by the advantages of a more capacious gastric remnant." Several technical difficulties are then discussed. Finally, there is a synopsis of some Glasgow data on the end results of gastrectomy: in over 400 cases, the operation was successful in 70 per cent, satisfactory in 20 per cent and a failure in 10 per cent.

An additional item of more than usual interest is the analysis of data on acute perforation, based on recent studies in Glasgow and Sweden.

Illustrations are adequate, with some histologic and pathologic plates in color. Selected bibliographies are included.

MAX THOREK, M.D.

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Men have to find truth; not because it is lost, but because they are lost.

—*Panin*

**Gastro-Esophageal Reflux in the Adult (A propos du reflux gastro-esophagien de l'adulte).** Hilleman, P., Wattebled, R., and Bennett: Presse Méd. 62:111, 1954.

When looked for, the passage of gastric contents into the esophagus without the participation of the gastric musculature is not as uncommon as it is thought to be. Bombart encountered up to 121 cases of reflux in 258 patients with various forms of dyspepsia.

Clinically, the condition may be latent and encountered only in the course of examination, or it may be revealed by dyspepsia, pyrosis, nausea and vague digestive complaints. When it is suspected, a barium meal is of greatest diagnostic value and the interpretation is quite easy: the roentgenogram shows retrograde filling of the esophagus by the contrast medium. After the stomach has been filled and the esophagus evacuated, an ascending refilling of the latter is diagnostic.

Esophagoscopic study may often help by revealing esophagitis, but this is not constant. The authors also point out that the extent of esophageal lesions is not in direct relation to the subjective symptoms.

Reflux may have a functional or a secondary cause. It may be secondary to a distal esophageal lesion, to a hiatus hernia, to an abnormality of the cardia, to sequelae of operation in that region or to brachiesophagus. Functional reflux may be due to cholecystic disease, to pregnancy or to no detectable cause at all. These come under the heading of esophageal dyskinesia.

The consequences of a long-standing reflux are variable degrees of esophagitis, even up to hemoptysis not unlike the massive hemorrhages associated with gastro-esophageal anastomotic ulcers.

The physiologic basis of reflux is sought but seems to vary with each case. If the mechanical theory, based on the valvular action of the cardia, finds support from the results of operations on the cardia, the sphincteric theory alone can explain the clinical aspects of functional reflux. Endocrine abnormalities, especially hypothyroidism, may also play an important role.

The problem remains complex, and treatment is bound to be variable.

S. A. GUEUKDJIAN, M.D.

**Fat Embolism: A Clinical and Experimental Study of Mechanisms Involved.** Swank, R. L., and Dugger, G. S.: Surg., Gynec. & Obst. 98:641, 1954.

In this paper the authors emphasize the early onset of cerebral fat embolism without pulmonary signs and symptoms, describing 2 cases of cerebral fat embolism in which these features were observed.

The early onset of cerebral fat embolism is due probably either to shock and unconsciousness or to anesthesia, both presumably relaxing the vascular bed and allowing the circulation of fat, which, plus the fat from the fractured bones, is washed through the pulmonary circulation to the brain.

It is suggested that dark field examination of whole blood to determine the number and size of the circulating fat globules in the blood would be useful in the early diagnosis of fat embolism.

EDMUND LISSACK, M.D.

**The Sphincter of the Pancreatic Duct: Its Role in the Pathology of the Pancreas (Le sphincter du Canal de Wirsung. Joue-t-il un rôle dans la pathologie du pancreas?).** Leger, L., and Lataste, J.: Presse Méd. 62:289, 1954.

There is a great deal of discussion of the sphincter of the pancreatic duct and its hypothetical role in biliopancreatic disease. Little, however, has been known of this sphincter. The authors have made a thorough anatomic and radiologic study of the problem to determine the exact role of the sphincter in disease of the pancreas.

Anatomically, it is known that the common bile duct and the pancreatic duct traverse the muscular layer of the duodenum separately, before they unite. There are muscular fibers around the common duct and the distal portion of the two ducts after their union. But the problems still remain: Are the fibers that encircle the ducts independent of those of the duodenal wall? Are there circular muscle fibers around the terminal portion of the pancreatic duct? At what level is the pancreatic sphincter—if any—situated? What is its role in disease of the pancreas?

Detailed histologic studies of transverse and longitudinal sections f the distal 3 cm.

of the pancreatic duct have shown that there exist (a) important circular muscle fibers, constituting the sphincter of Oddi; (b) some longitudinal muscle fibers; (c) other minor circular fibers, and (d) elastic fibers about 2 cm. proximal to the sphincter.

Correlated radiologic studies have shown that, from the physiologic point of view, the true pancreatic sphincter is identical with the upper part of the sphincter of Oddi.

The authors conclude that the inconstant, incomplete circular muscle fibers of the pancreatic duct just proximal to its juncture with the common bile duct do not exercise any efficient sphincteric action. In a cholangiographic procedure the reflux into the pancreatic duct seems to depend more on the equilibrium of pressure between the pancreatic sphincter.

These experiments indicate that the sphincter of the pancreatic duct does not play any important role in pathologic conditions of the pancreas.

S. A. GUEUKDJIAN, M.D.

**Plunging Ranula: A New Therapeutic Approach.** Keen, P.; Cohen, L., and Shapiro, M. P.: South African M. J. 28:189, 1954.

The plunging ranula appears to be rather rare outside the South African Bantus. In the author's opinion these cysts are of branchiogenetic origin and usually occur in the floor of the mouth at birth. During childhood the cysts enlarge and escape from the mouth by way of the weak spot in the oral floor, along the posterior border of the mylohyoid muscle, and then fill the space of the anterior triangle of the neck. Although small retention cysts in the floor of the mouth are easily curable by surgical treatment, the lesions considered here are the deep plunging variety that require extensive dissection for their complete removal, with inevitable recurrence if the removal is incomplete.

The conventional treatments require extensive operation, and even this frequently meets with failure. The treatment recommended by the author is aspiration of the contents of the ranula, followed by injection of 2 cc. bisoxyl (a 10 per cent aqueous suspension of bismuth oxychloride) into the remaining cyst cavity. The bisoxyl is then dispersed throughout the cavity by massage, after which the patient is treated by roentgen therapy, 180 Kv., 0.5 mm. copper filter, 50 cm. F.S.D., H.V.L. equal to 1 mm. of copper, field size usually 10 by 8 cm., a single dose of 300 r being administered to the skin overlying the affected submaxillary region.

This method of treatment is based on the assumption that a plunging ranula is a single cyst, for it is essential that the bismuth particles should reach all the cells lining the cavity if the treatment is to be effective.

The technical difficulties encountered include loculation due to previous operation or infection, and poor dispersion of the bismuth particles due to the large size and irregularity of the cyst cavity.

In the experience of the author, ranulas have been found resistant to conventional radiotherapy and as tolerant of radiation therapy as normal skin. In order to achieve complete destruction of such tissue, therefore, one would require a necrosis-producing dose of radiation—not less than 4 times the threshold skin-erythema dose, or 3,000 r of conventional high voltage roentgen rays delivered at a single sitting.

The authors have arbitrarily chosen for the treatment of ranulae after the injection of heavy metals (300 r normal skin dose), generally delivered through a single field. The more distal and peripheral portions of the cyst usually intersect the 30 per cent to 40 per cent isodoses, thus probably receiving no more than about 100 r from the direct beam. Since the authors have had no failures, they assume that the bismuth increased the intensity of the local ionization not less than thirty times. Secondary radiation for roentgen-irradiated matter consists largely of electrons, which is the photo-electric effect. With secondary electrons, their intensity increased non-linearly, with increasing atomic numbers and wave lengths. Bismuth, which has the highest atomic number of all nonradioactive elements, has therefore been chosen by the authors.

The distance traveled by a photo-electron in tissue is determined by the wave length of the radiation and the atomic number of the absorbing material. It was calculated that the effective range of this photo-electron in tissue was about 6 microns, which is somewhat less than the thickness of a single cell. The lining of a typical ranula consists, at least in the case of the so-called plunging variety, of a single layer of cuboidal epithelial cells, and therefore it is eradicated by this method, which would not be effective in cysts with thicker walls.

The authors report no failures in 25 consecutive cases in a series observed over the past three years.

HENRY J. ROSEVEAR, M.D.

**Menière's Disease. Successful Treatment by Minor Surgery.** Rosen, S.: Lancet 1:133, 1954.

The ideal operation for Menière's disease is one that preserves the hearing and the static labyrinth. By simple section of the chorda tympani nerve, 82 per cent of a series of 50 patients obtained relief of the attacks. This operation should be performed on all not cured by medical treatment before even considering the destruction of the labyrinth and auditory nerve.

Two cases are reported of severe Menière's disease on the side of a dead labyrinth. The internal ear is therefore not the exclusive structure from which the vertigo syndrome arises. The chorda tympani is a mixed sensory nerve carrying touch, pain, taste and sonic-equilibratory functions. Stimulations can pass up this nerve to the vestibular and cochlea nuclei, completely bypassing the internal ear.

CLAUDE M. WARREN JR., M.D.

**Exogenous Post-transfusional Hemochromatosis: An Anatomic Study (Hémochromatose exogène post-transfusionnelle. Etude anatomique).** Bousser, J., and Pean, G.: Presse Méd. 62:296, 1954.

Since Kark's first observation (1937) of exogenous hemochromatosis following repeated blood transfusions, 25 cases have been reported, including the present contribution. Previous reports have lacked pathologic details. In this work the authors present a thorough study of 4 cases and arrive at conclusions from anatomopathologic observations.

In the first case a boy aged 17 had Fanconi's disease; he was given 143 transfusions (43.5 litres of blood). In the second a man aged 44, with Hodgkin's disease, was given 26 transfusions. In the third case a woman, 77 years old, with Kalher's disease, was treated with 20 transfusions, and the fourth, a man of 60, with the same disease, underwent 25 transfusions.

The main anatomopathologic features of exogenous hemochromatosis are stated: (a) visceral siderosis, (b) hepatosplenogandular sclerosis and (c) parenchymatous hepatitis. The condition is in some ways analogous to idiopathic pigmentary cirrhosis. Siderosis is diffuse and especially massive in the liver, glands, spleen, pancreas, thyroid, adrenals and myocardium, in that order. The pituitary, testicle, kidneys and lungs are only slightly siderotic, and the intestine and skin escape. Sclerosis is invariably associated with the disease, and in the liver it is primarily periportal. Sclerosis of the glands and spleen is also marked, but other organs are not so deeply affected. Intercurrent hepatitis, although not necessarily present, is a common complication.

The anatomic picture of exogenous hemochromatosis has many features parallel with those of idiopathic pigmentary cirrhosis, and these analogies are discussed in the light of histologic observations.

Excellent color photomicrographs and an international bibliography enrich this excellent study.

S. A. GUEUKDJIAN, M.D.

**Intravenous Cholangiography: Its Status in the Radiologic Exploration of the Biliary Tract (La cholangiographie par voie veineuse. Sa place dans l'exploration radiologique des voies biliares).** Seneque, J.; Le Canuet, R.; Debray, C.; Roux, M., and Aussage, J.: L. Presse Méd. 62:281, 1954.

A new product with a 64 per cent iodine content is tested for intravenous cholangiographic study. It is stated that this radiopaque medium is rapidly eliminated by the liver, thus giving a clear picture of the biliary tract. If liver function is deficient, the solution is eliminated by the kidney, which yields a pyelogram.

Biligrafin, as the solution is known, bypasses the portal circulation, for there is no enterohepatic cycle like that associated with cholecystographic examination by the oral route. It also does not depend on the integrity or even the presence of the gallbladder.

The authors have observed that it is well tolerated in spite of its high iodine content, and no case of iodism has been reported. One is advised, however, to take the usual precautions, and for patients with hepatic failure it may be better not to use this route.

The technics of administration and the radiographic details are discussed. It is advised to inject 8 Gm. (2 ampules of a 20 per cent solution) in six to eight minutes.

In ten minutes the hepatic and common ducts begin to be visualized. The gallbladder fills at about the fifteenth minute, and the shadow deepens progressively. Passage into the duodenum is very rapid. In twenty-four hours the whole of the contrast medium is in the colon. Pictures obtained with this substance are more extensive — not necessarily clearer — than those taken after use of products heretofore employed. The minutiae of interpretation of normal and abnormal cholangiograms are discussed, with good illustrations and sketches.

Intravenous cholangiographic study yields far more information on hepatobiliary disease than does the oral type and can be used even where the gallbladder has been removed or is excluded.

The intravenous route is recommended in all cases in which the oral route has given insufficient information and for all patients who have undergone cholecystectomy.

S. A. GUEUKDJIAN, M.D.

**Some Observations Concerned with Carcinoma of the Breast: Part V.** Miller, M. W., and Pendergrass, E. P.: Pennsylvania M. J. 57:421, 1954.

This report establishes statistically the penalties incurred by the patient when she ignores the symptoms of disease or delays in consulting her doctor after her discovery of a lesion. It is a reasonable inference that public education will reduce the tragic time interval in both instances. It is also probable that improvement in the survival rate may result from periodic self-examination of the breast rather than from accidental discovery by the patient herself of a local lesion in the breast.

EDMUND LISSACK, M.D.

**Cholangio-Cholecystography: Its Pharmacology. Preliminary Observation on 100 cases (Cholangio-cholécystographie. Considérations préliminaires sur 100 observations — Action pharmacodynamique).** Nemours-Auguste, S., and Barag, N.: Presse Méd. 62: 300, 1954.

Intravenous cholangiographic study presents different possibilities for assessing hepatic function and studying the biliary tract. According to Rosental, one-third of the liver must be intact before normal function is possible. If the liver is healthy, intravenous cholangiographic examination gives good visualization of the bile ducts. If there is hepatic insufficiency one of the following eventualities is possible: (a) nonvisibility of the hepatic ducts; (b) delayed visibility of the gallbladder; (c) nonvisibility of all the bile ducts, or (d) elimination of the contrast medium not by the liver but by the kidney, resulting in the need for a pyelogram.

Cases are recorded in which this procedure produced a diagnostic picture when the usual methods of examination had failed. The authors present interesting contrast pictures.

The mechanism of the bile ducts and the pharmacologic character of the contrast media were studied by different methods. Noting that 1 cc. of morphine accelerated the excretion of the opaque substance by the liver, the authors used it whenever the bile ducts were poorly visualized. This morphine reaction had never been recorded before this report of observations made on 100 cases. Inhalation of amyl nitrite helped to fill the common bile duct by relieving the painful spasm. Boyden's meal activated the evacuation of bile (and the opaque medium) both in patients whose gallbladders were normal and in patients who had undergone cholecystectomy or had excluded gallbladders.

This new intravenous cholangiographic medium, (N-adipino-di (3-amino-2, 4, 6, tri-iodo phenyl—sodium-carbonate) is claimed to have opened new possibilities in roentgen diagnosis of diseases of the bile ducts.

S. A. GUEUKDJIAN, M.D.

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When a man has anything to tell in this world, the difficulty is not to make him tell it, but to prevent him from telling it too often.

—*Shaw*

# The Journal of the International College of Surgeons

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## CONTENTS—DECEMBER, 1954

Shearing Injury to the Sacroiliac Joint .......... 631
*George S. Hackett, M.D., F.A.C.S., Canton, Ohio*

Differential Diagnosis and Treatment of Lesion of the Cervix .......... 643
*A. M. Hansen, M.D., F.A.C.S., F.I.C.S.; Mary H. Jennings, M.D., F.A.A.O.G., and Clarence L. Wood, M.D., A.A.G.P., Los Angeles, California*

Pollicization of the Ring Finger .......... 649
*Roger Letac, M.D., F.I.C.S., Dakar, French West Africa*

Malignant Intra-Abdominal Nonchromaffin Paraganglioma: Report of a Case with Survival of Eleven Years .......... 656
*James Rae Arneill, M.D., F.I.C.S.; Samuel H. Haigler, M.D., F.A.C.S., and Lucito G. Gamboa, M.D., Denver, Colorado*

Treatment of Lithiasis of the Principal Biliary Channels: New Instruments ........... 664
*Caetano Zamitti Mammana, M.A., F.I.C.S., São Paulo, Brazil*

Surgical Treatment of Polycystic Kidney: Report of First Case Complicated by Cholesteatoma ........... 673
*Charles Pierre Mahê, M.D., F.A.C.S., F.I.C.S., San Francisco, California*

Surgical Drainage ........... 683
*Rafe C. Chaffin, M.D., F.A.C.S., F.I.C.S., Los Angeles, California*

Tumor of the Glomus Jugulare Resembling Brain Tumor ........... 691
*William R. Chambers, M.D., F.I.C.S., Atlanta, Georgia*

The Painful and Stiff Shoulder: A Plan of Treatment Based on Known and Theoretical Factors: Plea for Standardization in Evaluation of Results ........... 695
*Samuel L. Turek, M.D., F.I.C.S., Chicago, Illinois*

Allergenic Tissue Reaction of Catgut, and Aid for the Obliteration of Varicose Veins ........... 707
*Egmont J. Orbach, M.D., F.I.C.S., New Britain, Connecticut*

Carcinoma of the Penis ........... 711
*J. Reese Blundell, B. S., M.D., F.I.C.S., Houston, Texas*

The Surgical Implications of Ductus Arteriosus Patency in Cases of Fallot's Tetralogy and Corvisart's Complex ........... 714
*Rustom Jal Vakil, M.D. (Lond.), M.R.C.P. (Lond.), D.T.M.&H. (Lond.), F.R.F.P.S.G., F. C. P. S., F.A.Sc., Bombay, India*

Tendon Transfer in Early Childhood: The Importance of Anchorage Technic for Successful Results ........... 719
*Amon Fried, M.D., F.I.C.S., Petach-Tiquah, Israel*

Surgical Treatment After Radical Cystectomy: Report of a Case ........... 723
*Sidney Vernon, M.D., F.A.C.S., F.I.C.S., Willimantic, Connecticut*

Thyroidectomy for Struma Lymphomatosa (Hashimoto's Disease): Report of a Case with Unusual Operative Complications ........... 726
*Mandel Weinstein, M.D.; Morton Roberts, M.D., and George M. Hadda, M.D.*

A New Bipolar Electrocoagulator for Hemostasis ........... 733
*Carlo Scuderi, M.D., Ph.D., F.A.C.S., F.I.C.S., Chicago, Illinois*

SECTION ON OPHTHALMOLOGY AND OTORHINOLARYNGOLOGY

Axis Traction Cataract Extraction with Vacuum ........... 737
*Oscar B. Nugent, M.D., F.A.C.S., F.I.C.S., and John W. Vertuno, M.D., F.I.C.S., Chicago, Illinois*

Sinurespiratory Infections ........... 743
*L. C. Boemer, M.D., F.A.C.S., F.I.C.S., St. Louis, Missouri*

EDITORIAL

Changing Trends in Wound Dressings ........... 747
*Carroll J. Bellis, M.S., Ph.D., M.D., F.A.C.S., F.I.C.S., D.A.B.S., Long Beach, California*

NEW BOOKS ........... 749

ABSTRACTS FROM CURRENT LITERATURE ........... 751

VOLUME INDEX ........... 757

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The Journal of the
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# *Original Articles*

## Shearing Injury to the Sacroiliac Joint

GEORGE S. HACKETT, M.D., F.A.C.S.*
CANTON, OHIO

A SHEARING injury to a joint is one in which the two bones are forced in different directions with sufficient force to stretch or tear the ligaments that normally support the articulation. The shearing action is similar to what occurs when one blade of a pair of shears is forced in the opposite direction from the other blade. The victim may be either the driver or a passenger. The injury takes place in the sacroiliac joint when the automobile is struck either in the front or in the rear. The injury is occurring with greater frequency nowadays, owing to the increase of automobiles, speed, stop signs and traffic lights.

*Mechanism.*—The mechanism of the injury consists in forward propulsion of the body, including the sacrum, while the rigid leg "brakes" against either the foot brake or the floor of the car as the ilium is forced backward; this results in a transverse shearing action between the ilium and the sacrum. The fibers of the posterior portion of the sacroiliac and the interosseous sacroiliac ligaments are sprained or torn (Case 1).

This shearing action in the sacroiliac joint also takes place when the force is directed in a vertical plane as when one falls in a sitting position on one or both ischial tuberosities, and the force is directed upward through the ilium as the sacrum, with the weight of the torso, is propelled downward (Case 2).

The injury to the ligaments may clear up in a few weeks or it may result in permanent relaxation of the ligaments, as described by Shands, causing the sacroiliac joint to be more susceptible to sprain and pain, as was pointed out by Mengert.

It is important to describe this shearing injury to the sacroiliac ligaments because, in the majority of the cases I encounter,

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Submitted for publication July 30, 1954.

either for treatment or for examination only, it has not been recognized—although the patients had been unsatisfactorily treated as they went the rounds of physicians and practitioners (Case 3).

*Joint Structure.*—The relation of the bones of the pelvis, in which the sacrum is an inverted keystone of the arch, makes the sacroiliac articulation more susceptible to injury by sudden forcing backward of the ilium. In addition, the fact that the sacroiliac joint is considered a gliding joint (Francis) makes it more susceptible to a shearing injury. The bones are held together by ligaments.

According to Steindler, the interosseous sacroiliac ligament, which lies deep beneath the posterior sacroiliac ligament, has fibers coursing in a diversity of directions. This indicates their importance in receiving and resisting stresses and strains from all sides.

The sacroiliac articulation normally has a transverse as well as a rotational movement, as was pointed out by Newman. He further stated that the range of motion of the sacroiliac joint in the male slowly decreases from puberty until the sixth or seventh decade of life. In the female the motion increases from puberty until the age of 25 and then slowly declines, but even late in life there is an appreciable range of movement.

Unquestionably the sacroiliac ligaments have an important function and are submitted to considerable strain to limit the motion in the joint. This accounts for their developing to such remarkable size and strength. They are subject to injury and degeneration, which cause relaxation of the ligament. Pain results when the relaxed ligaments are under strain because the nerves in the ligaments are under abnormal tension.

Leriche pointed out that the ligaments near their bony attachments are richly supplied by sensory nerves. This makes them particularly susceptible to pain after they have been weakened.

It is my opinion that much of the weakness associated with relaxation of the ligaments is at the point of their attachment to the periosteum and that this accounts for the pain that results when relaxed ligaments undergo ordinary stress. It also accounts for the relief of pain when the ligament has been strengthened by proliferation. Figure 3 shows the increase of fibrous tissue and bone resulting from the injection of a proliferating solution into rabbits, as tested by myself.

*Symptoms.*—Pain is to one side of the sacrum, may be continuous or recurrent and is susceptible to acute aggravation. If referred, the pain usually goes outward and downward from the sacroiliac joint into the outer lower quadrant of the buttock, frequently extending downward along the posterolateral aspect of the thigh and sometimes down along the fibula to within 2 inches (5 cm.) of the external malleolus (Baer, J. Travell, and W. Travell).

Local pain and referred pain are frequently reproduced by the needle or by the immediate pressure of the anesthetic as it is introduced into the ligament, according to J. Travell, W. Travell and Steinbrocker. The pain subsides within two minutes.

The reproduction of local pain in the ligament, as well as the referred pain caused by needling, followed by the disappearance of these pains from the interligamentous action of the anesthetic, is definite evidence that the disability lies within the ligament. Further conclusive evidence will be presented later, together with an account of the strengthening of the ligaments by sclerosis, which resulted in permanent freedom from discomfort and restoration of function.

I have observed that the referred pain

*is transmitted to the groin and to the anterior medial surface of the thigh* if, in addition to the relaxation of the upper fibers of the posterior sacroiliac ligament, the iliolumbar ligament supporting the fifth lumbar vertebra is also relaxed. The marginal fibers of the two ligaments are contiguous and crisscross.

I have also made the observation that, from the lowermost portion of the posterior sacroiliac ligament and the uppermost portion of the long posterior sacroiliac ligament, the referred pain is transmitted down the course of the sciatic nerve; i. e., in the back of the thigh and *into the calf of the leg as far as the juncture of the upper and middle thirds of the leg.* The pain has rarely been observed to extend into the lower half of the leg and never into the foot or toes.

I have reproduced these local and referred pains by the irritation with the needle and by the pressure of a local anesthetic. They disappear entirely within two minutes as the action of the anesthetic takes place.

*Diagnosis.*—As a result of these experiences, I have developed an important and simple method of diagnosis of sacroiliac sprain or relaxation. This consists of *making pressure with the thumb over the posterior sacroiliac ligament.* It is necessary to have the patient *in complete relaxation* when pressure is made, *with the thumb on the tender points,* if positive pain is to be elicited.

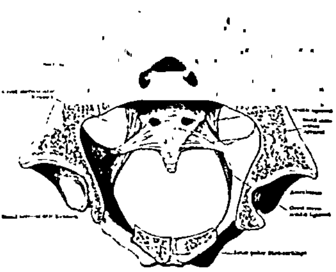

Fig. 1.—Coronal section of pelvis.

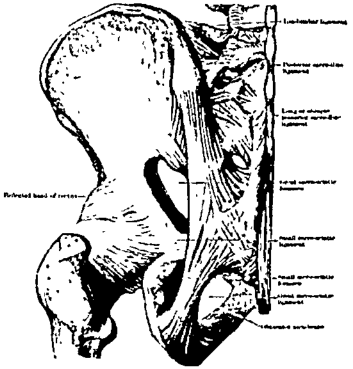

Fig. 2.—Posterior view of the pelvic ligaments of the hip joint.

The diagnostic test is accomplished as follows: The patient stands with feet together, knees extended, body bent fairly well forward and arms hanging free. *The examiner stands behind and somewhat to the left of the patient.* The examiner's left hand is placed on the patient's abdomen, or he may gently grasp the patient's left shoulder with his left hand. The right thumb is placed close to the medial edge of the crest of the ilium, just above the posterior superior spine. The patient then assumes the erect relaxed position (chin up; shoulders, arms and fingers hanging free) and gentle but firm pressure is made with the thumb. If the sacroiliac joint is involved, the patient will flinch and tell the examiner "That is the [illegible] xamin [illegible] then com- [illegible] e o [illegible] ac joint, with the lumbosacral depression, and again with the suspected side, making pressure higher and lower in relation to the posterior superior spine of the ilium. The tender points should be marked with a pen for later insertion of the needle. This is the most valuable of all tests; it is easily accomplished, and it almost always gives positive results when the sacroiliac joint is involved.

The many leg tests produce such confusing pain and tension in the patient that I avoid them until after the tender points have been located.

A frequently used leg test is made with the knee and hip flexed while the patient lies on his back. Pain on rotation of the femur indicates disability of the hip joint. It is accompanied by pain and tenderness in the crease beneath the buttock, just lateral to the course of the sciatic nerve.

*Confirmation of Diagnosis.—Acute condition*: To confirm the diagnosis in all cases of disability of the sacroiliac ligament and for relief of pain in those acutely affected, have the patient lie in the prone position comfortable and relaxed, as described by Haldeman.

Check again for the tender points.

Attach a syringe with 10 cc. of a long-lasting local anesthetic to a 2½ inch (6.9 cm.) 22-gauge safety needle. Insert the needle through the skin ½ inch (1.2 cm.) from the midline, just medial or slightly above the anterior spine of the ilium at an angle of 45 degrees. Inject the anesthetic ahead of the needle fanwise in two directions as the needle is introduced. Then withdraw the needle. The patient arises and in a few minutes is able, without pain, to go through movements he was unable to do before. This is evidence that the joint pain is located in the ligaments and confirms the diagnosis.

*Chronic Condition*: In the presence of a severe sprain that does not clear up in a few weeks and in cases of the relapsing chronic relaxation of the posterior sacroiliac ligament, the treatment as described by the author consists of the injection of 5 cubic centimeters of long lasting local anesthetic into the most tender area ahead of the needle until it is inserted usually its full length. While the needle remains in place, 1 cc. of a sclerosing solution is injected into the ligament, not into the muscle or subcutaneous tissue, as the needle is withdrawn. The patient arises and pursues his ordinary activities.

*Insertion of Needle.*—The depth to the sacroiliac joint margin beneath the posterior superior spine of the ilium is very shallow. After the needle has passed through the sacrospinalis muscle it will traverse the ligament only 1 inch (2.5 cm.) or less before impinging against the undersurface of the ilium. Some of the sclerosing solution should be deposited at its point of deepest penetration to strengthen the ligament at its attachment to the periosteum.

The greatest portion of the ligament lies above the posterior superior spine, and its position is deeper beneath the thicker sacrospinalis muscle. Insert the needle at an angle of 45 degrees through approximately 1½ inches (3.7 cm.) of muscle before entering the ligament.

Below the posterior superior spine the needle must be inserted much more shallow and will enter the ligament ½ to 1 inch (1.2 to 2.5 cm.) beneath the skin. It will pass close beneath the thick attachment of the long posterior sacroiliac ligament to the posterior superior spine to a depth of 2 inches (5 cm.) as it traverses the vertical fibers of the posterior sacroiliac ligament, which lie between the posterior superior and inferior spines of the ilium.

If there is tenderness on pressure over the thick end of the long posterior sacroiliac ligament at its attachment to the posterior spine, the needle should be inserted vertically into the ligament and the sclerosing solution distributed through the upper 1½ to 2 inches (3.7 to 5 cm).

*Frequency of Treatment.*—In case of acute involvement, treatment with the anesthetic only is usually sufficient. It may be repeated.

When the involvement is chronic and consequent relaxation of the ligament has occurred, the sclerosing solution is usually administered twice a week, but multiple injections may be given more frequently, particularly if the patient is hospitalized. Usually, cure can be obtained with approximately six treatments. Sometimes fewer treatments will suffice, and occasionally more are necessary. The tender point is located for each treatment.

A record is kept of the position selected for each injection. Each subsequent injection avoids the site of the previous one.

When the patient feels that the joint is stabilized, the treatments are discontinued, and he returns for reevaluation after two weeks and then at longer intervals. Residual pain indicates additional treatments.

During the course of treatment the patient pursues whatever activities he is able to perform but avoids any unnecessary strenuous activity.

*Drugs.*—During treatment some patients do not require any analgesics, but it is advisable to provide them with codeine, ½ to 1 gr., or Demerol, 50 to 100 mg., with acetylsalicylic acid, 10 gr., in order to assure them of comfort.

*Additional Therapy.*—Heat or an ice bag with analgesic balm frequently adds to the patient's comfort. A sacroiliac belt or girdle may be worn during treatment if he desires.

A man's belt worn very tightly just above the pubes binds the sacroiliac joints and gives relief of sacroiliac disability, but to no other condition. Consequently it is also of diagnostic significance. Some patients, even women, avail themselves of it during treatment, particularly while doing their work, even wearing it over the girdle. It is always preferable to adhesive tape. I have observed the belt worn outside the trousers by workmen in many countries.

*Reduction.*—Reduction of a slight subluxation of the sacroiliam joint will sometimes facilitate the treatment. A simple method designed by myself has been highly effective. The patient lies in the supine position with the hip and knee on the affected side flexed at right angles. The assistant makes pressure on the opposite side of the pelvis. Upward traction is made on the femur with the operator's flexed elbow beneath the patient's flexed knee, and traction is continued until the leg is brought down onto the table.

Figures 1 and 2 show the location and size of the posterior sacroiliac ligament and indicate its importance in supporting the sacroiliac articulation. Figure 1 also shows the accessibility of the posterior sacroiliac ligament for insertion of the needle both in diagnosis and in treatment.

Figure 2 reveals the continuity between the upper portion of the posterior sacroiliac and the iliolumbar ligaments to stabilize the fifth lumbar, sacrum and ilium articulations, as described by Francis.

Figure 3 shows the comparative size of rabbit tendons nine months and twelve months, respectively, after injection of the sclerosing solution, and the controls in each case (from the same rabbit) which were not treated by injection. The tendons selected were the gastrocnemius and superficial flexor at the point where they are joined together and attached to the tuber calcus of the tibial tarsal bone.

In each case there were three injections of the sclerosing solution; one at the beginning, the second six weeks later, and [illegible] three an [illegible] h[illegible] months later.

Each specimen shows an increase of 40 per cent in diameter of the treated tendon as compared with the control, and the dimensions of the bone with its periosteum and tendon attachment are increased 30 per cent in each case. An increase of 40 per cent in diameter indicates an increase of 100 per cent in strength.

The tissue of the tendon treated by injection is firm, strong and healthy. No inflammation or degenerative change was present.

This experimental work with histologic slides from one day to one year will soon be reported. It complements the earlier work on other tissues of man and animals by Rice, Rice and Mattson, Maniol, Harris, White and Biskind.

The new fibrous tissue develops between the strands of the tendon, which run in various directions, thus promoting additional strength and limitation of motion.

## COMMENT

Many injuries to the sacroiliac joint in automobile accidents occur in other than head-on collisions. Frequently the sacroiliac disability does not cause discomfort in confining injuries until the more serious injury has cleared up and permitted the patient to become active. Often this type of condition is never recognized, since the pain is thought to be due to the fractured vertebra, pelvis or femur.

*Statistics:* In the past fifteen years I have used sclerotherapy in 432 cases of relaxation of the posterior sacroiliac ligament, examining and making a diagnosis in an equal number of cases in which the patients were referred for survey only. The latter group had received some form of treatment, although in fully half of the cases no sacroiliac disability had been recognized.

As I have reported previously, a survey of 197 cases of sacroiliac relaxation treated during the twelve-year period between 1939 and 1950 inclusive was compiled two years later. An effort was made to communicate with each patient. Follow-up data were obtained from 84 patients, 37 by personal examination and 47 by means of a detailed questionnaire. The average duration of disability before treatment was four and onehalf years, the longest thirty years. Fifty-three per cent of the patients were women. Of the 84 surveyed, 69, or 82 per cent considered themselves entirely cured at the time of the most recent communication.

Failures may be attributed to: (1) a diagnosis not definite and clearly confirmed by the injection of a local anesthetic; (2) failure of the patient to complete the course of treatment, and (3) treatment given in the presence of some other known disability. With proper diagnosis, in the absence of complications, failures should be reduced to a minimum.

In approximately 2,500 injections no infection, hematoma, sloughing, paralysis, paraesthesia or any other detrimental result has occurred.

*Complications:* In many instances in which hypertrophic arthritis has been revealed in the roentgenograms, ligamental sclerotherapy has relieved or eliminated the pain when examination revealed the tender points to be located over the supporting ligament.

In many "suspicious cases" of ruptured intervertebral disc there is obvious relaxation of the sacroiliac ligaments. Stabilization of the relaxed ligaments during the period of observation of the disc will obviate many laminectomies and fusions and will strengthen the back in case a laminectomy is performed later.

*Roentgen Examination:* Roentgenograms are usually of no value in detecting disability of the sacroiliac ligaments, but they are valuable in calling attention to congenital or acquired deformities or bone lesions.

*Sclerlosing Solution:* The sclerosing solution used throughout was Sylnasol (G. D. Searle & Co.), which is a mild sodium salt of fatty acid and possesses the desirable features laid down by Rice: (1) no systemic reaction; (2) minimal exudate reactions; (3) maximum production of new fibrous connective tissue, and (4) no undesirable histologic changes.

*Anesthetic:* The local anesthetic employed in treatment of the last most recent cases appears to meet the requirements better than several other local anesthetics previously employed. It contains procaine 2 per cent, ammonium sulfate 2.5 per cent and benzoic acid 2 per cent. It obtains better immediate anesthesia, which is desirable when a small amount of anesthetic is used in areas susceptible to pain, such as the periosteum. The anesthetic action is prolonged for several hours.

*Diagnostic Error:* Many diagnosticians have apparently forgotten that the spine of the fifth lumbar vertebra extends downward over the upper margin of the sacrum, and when tenderness is observed to either side of the lumbosacral depression it is over the attachment of the upper portion of the tender relaxed posterior sacroiliac ligament. It is for this reason that, in many cases of sacroiliac disability, the condition has been wrongly diagnosed as a lumbosacral disability.

When relaxation of the ligaments supporting the lumbosacral articulation occurs, one "tender point" is located over the outer end of the iliolumbar ligament, just medial to its attachment to the ilium. This point is located adjacent to the crest of the ilium, at a point midway between a line drawn transversely across the highest point of the iliac crests and another line running transversely through the lumbosacral depression. The other "tender point" is in the midline in the lumbosacral depression, which is over the tender relaxed supraspinous and interspinous ligaments.

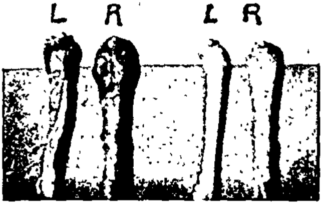

Fig. 3.—Photograph of rabbit tendons at nine and twelve months after three injections of proliferating solution into the right tendons. *Left*, controls; *right*, proliferated. The tendons on the right reveal an increase in diameter of 40 per cent, which is estimated to double the strength of the tendon. The upper portion reveals the attachment of the ligament to the bone which has increased 30 per cent in diameter. The proliferating solution stimulates the production of new fibrous connective tissue cells which become organized into permanent non-elastic fibrous tissue.

Frequently relaxation of the iliolumbar ligaments on one or both sides coexists with relaxation of the posterior sacroiliac ligament and responds favorably to sclerotherapy. An article on stabilization of the lumbosacral articulation will appear later.

REPORT OF CASES

CASE 1.—A woman aged 40, a taxicab driver, stopped suddenly for a red light, and her cab was struck in the rear by a light truck. The accident occurred on the Public Square, within view of my office window, while I was observing traffic. The truck backed to the curb and parked. The taxicab drifted backward and was stopped when a pedestrian opened the door and put on the brake. The woman was lifted from the cab in a limp condition and placed on the sidewalk. An ambulance took her to Mercy Hospital. After the taxi drifted backward, I observed the exact outline of her car on th [illegible] at the site of collision by the dry dirt that had been knocked from underneath it by the force of the impact. I was on service at the hospital at the time and later was notified of her admission.

Examination disclosed a whiplash injury of the neck, with sprained ligaments and concussion of the cervical portion of the spinal cord. Roentgenograms revealed no abnormality. She was hospitalized for four weeks.

Sacroiliac pain on the right side developed one week later, as she became more active, and a diagnosis of shearing injury to the right posterior sacroiliac ligament was made. She was given eight injections in five weeks, resumed her former activities in three months *and remained cured for eight years.*

In June 1952 the symptoms recurred when she bent forward to lift something from the bottom of a barrel. She stated that she had felt a "snap" in her right hip and severe pain similar to that which she had had before. Two injections into the right posterior sacroiliac ligament failed to give the customary relief. After the third injection, upward traction on the extremity with the knee and hip flexed and the patient in the supine position reduced what appeared to be a slight subluxation and assisted in the cure. At the time of writing, she has been entirely free from pain and has been performing her usual activities for two years. She was last seen in April 1954.

CASE 2.—On June 9, 1953, a housewife aged 58 missed the second step of a ladder and fell to the floor in a sitting position. She was confined to bed at home for two weeks under the care of the family physician. She was unable to take a step away from the bed or to bear any weight on the left foot. She was taken to the hospital by ambulance. Local anesthetic infiltration of the left posterior sacroiliac ligament gave relief, and she took a few steps. Roentgenograms of the pelvis by the Chamberlain technic as described by Anderson and Peterson, revealed the left pubes to be higher than the right. There was no fracture.

Six injections of sclerosing solution were given in an eight-day period, and the patient returned home by automobile on the ninth day. Six days later she walked into my office, and a few days later drove 100 miles, returning home two days later.

Three weeks after leaving the hospital she was given one injection of sclerosing solution and two weeks later drove 3,000 miles to California, returning by automobile after one month.

At the time of this report she is doing all her housework and has remained free from discomfort. The last contact was in April 1954.

CASE 3.—In February 1951, a housewife aged 56 was a passenger in the front seat of an automobile involved in a head-on collision. Her injuries were concussion of the brain and a contusion of the head, the impact shattering the windshield. She was hospitalized for two days and in bed for one week at home, and she was inactive for several weeks.

As activity increased, pain developed in the left sacroiliac joint. The first examination, in December 1951, revealed relaxation of the left posterior sacroiliac ligament of ten months' duration, which had not been diagnosed.

The pain was relieved by injection of a local anesthetic. Complete relief was obtained after six injections of a sclerosing solution, and one month later the patient made a 5,000 mile automobile trip without discomfort. At the time of writing she has remained free from trouble for two and one-half years. She was last seen in April 1954.

## SUMMARY AND CONCLUSIONS

1. Shearing injury to the ligaments of the sacroiliac joint occurs frequently, is often not diagnosed and may result in permanent relaxation of the posterior sacroiliac ligament.

2. Relaxation of the upper portion of the posterior sacroiliac ligament is frequently diagnosed as lumbosacral disability because the posterior superior spine of the lumbar vertebra extends downward below the level of the top of the sacrum, and the tenderness lateral to this depression is over the upper portion of the posterior sacroiliac ligament.

3. The area of referred pain is described, which assists in the differential diagnosis of disability referable to the lower part of the back.

4. A new simplified diagnosis is described, which depends on pressure over the posterior sacroiliac ligaments.

5. The diagnosis is confirmed by infiltration of the ligament with a local anesthetic, which abolishes or relieves the pain.

6. Acute conditions may be relieved by infiltrating the posterior sacroiliac ligament with a solution of a longlasting local anesthetic.

7. The joint injuries in which relaxation of the ligament results may be cured by sclerotherapy.

8. Illustrative cases are described.

Shearing injury to the ligaments of the sacroiliac joint occurs frequently, often is not diagnosed, and result in permanent relaxation of the posterior sacroiliac ligament. Relaxation of the upper portion of the posterior sacroiliac ligament is frequently diagnosed as lumbosacral disability because the posterior spine of the fifth lumbar vertebra extends downward below the level of the top of the sacrum, and the tenderness lateral to this depression is over the upper portion of the posterior sacroiliac ligament. Determination of the area of referred pain assists in the differential diagnosis of disability referable to the lower part of the back.

A new simplified diagnosis is described, which depends on pressure over the posterior sacroiliac ligaments. The diagnosis is confirmed by infiltration of the ligament with a local anesthetic, which abolishes or relieves the pain.

Acute conditions may be relieved by infiltrating the posterior sacroiliac ligament with a solution of a long-lasting local anesthetic. The joint injuries in which relaxation of the ligament results may be cured by sclerotherapy.

Injection of sclerosing solution into rabbit tendons induced the production of new fibrous tissue and permanently increased the diameter of the tendon by 40 per cent in comparison with controls. The computed increase in strength is approximately 100 per cent.

Four hundred and thirty-two patients with disability referable to the posterior sacroiliac ligament have been treated. Cures lasting up to fourteen years have been attained in 82 per cent of the cases. No unfavorable incident has occurred in approximately 2,500 injections. Illustrative cases are described.

## RESUMEN

El desgarramiento de los ligamentos de la articulación sacroilíaca ocurre frecuentemente, a menudo no es diagnósticado y puede producir una relajación permanente del ligamento sacroilíaco posterior. La relajación de la parte superior del ligamento sacroil íaco posterior se diagnóstica frecuentemente como incapacidad lumbosacra a causa de que la espina posterosuperior de la quinta vertebra lumbar se extiende hacia abajo por debajo del nivel de la parte superior del sacro, encontrándose dolor lateral en esta depresión y sobre la parte superior del ligamento sacroilíaco posterior. La determinación del área de dolor referido ayuda en el diagnóstico diferencial de incapacidad de la parte inferior de la espalda.

Se describe un nuevo diagnóstico simplificado que depende de la presión sobre los ligamentos sacroilíacos posteriores. El diagnóstico se confirma por la infiltración ligamentaria con anestesia local, que abole ó alivia el dolor.

Los estados agudos pueden ser aliviados per la infiltración ligamentaria sacroilíaca posterior con una solución anestésica de larga duración. Las lesiones articulares en las cuales la relajación ligamentaria se produce pueden ser curadas por escleroterapia.

La inyección de soluciones esclerosantes en los tendones del conejo indujeron la producción de nuevo tejido fibroso y aumentó permanentemente el diámetro del tendon en 40 por ciento con relación a los testigos. El aumento computado en fuerza fué aproximadamente de 100 por ciento.

Se han tratado cuatrocientos treinta y dos pacientes con incapacidad referida al ligamento sacroilíaco posterior, obteniéndose en el 82 por ciento de los casos curas de catorce años de duración. En 2,500 inyecciones no se produjo ningun accidente desfavorable. Se describen casos ilustrativos.

### ZUSAMMENFASSUNG

Verletzungen der Bänder des Iliosakralgelenks infolge von Scherenden Kräffen kommen häufig vor und bleiben oft unerkannt. Die Verletzung kann zu einer dauernden Erschlaffung des hinteren Iliosakralligaments führen. Häufig wird die Erschlaffung des oberen Abschnitts des hinteren Iliosakralligaments als eine Untauglichkeit des Lumbosakralgelenks aufgefasst, weil der hintere obere Fortsatz des fünften Lendenwirbels sich nach unten über die Höhe der Kreuzbeinbasis hinaus erstreckt und die schmerzempfindliche Stelle seitlich dieser Vertiefung über dem oberen Abschnitt des hinteren Iliosakralbandes liegt. Von differentialdiagnostischen Wert in der Erkennung von Untauglichkeiten des unteren Rückenabschnitts ist die Bestimmung der Ausstrahlungsgebiete des Schmerzes.

Es wird ein neues vereinfachtes diagnostisches Verfahren beschrieben, das auf Druck auf das hintere Iliosakralligament beruht. Die Diagnose wird durch Infiltration des Ligaments mit einem lokalen Anästhetikum, die zur Erleichterung oder Behebung des Schmerzes führt, bestätigt.

Akute Erkrankungen können durch Infiltration des hinteren Iliosakralbandes mit einem örtlichen Anästhetikum von langanhaltender Wirkung geheilt werden. Gelenkschädigungen, zu denen die Erschlaffung des Ligaments führen kann, sind der Behandlung mit sklerosierenden Mitteln zugänglich.

Die Einspritzung einer sklerosierenden Lösung in die Sehnen von Kaninchen führte zur Bildung neuen faserigen Bindegewebes und zu einer bleibenden Vergrösserung des Sehnenquerschnitts um 40 Prozent im Vergleich mit Kontrollversuchen. Die Zunahme der Sehnenkraft beträgt durchschnittlich 100 Prozent.

Unter 132 wegen Untauglichkeit des hinteren Iliosakralligaments behandelten Kranken wurden Heilungen, die bis zu 14 Jahren anhielten, in 82 Prozent der Fälle erreicht. Unter 2500 Einspritzungen kam es zu keinerlei unerwünschten Zwischenfällen. Erläuternde Krankheitsfälle werden beschrieben.

### RÉSUMÉ

La lésion de Shearing des ligaments de l'articulation sacro-iliaque est fréquente; elle n'est souvent pas diagnostiquée et peut provoquer un relâchement permanent du ligament sacro-iliaque postérieur. Le relâchement de la partie supérieure du ligament sacro-iliaque postérieur est souvent pris pour une affection lombo-sacrée parce que l'épine postéro-supérieure de la 5e vertébre lombaire s'étend vers le bas audessous du niveau du sommet du sacrum, et la zone douloureuse à la pression se trouve au-dessus de la portion supérieure du ligament sacro-iliaque postériur. Le diagnostic différentiel de l'affection de la partie inférieure du dos est facilité par la détermination de la zone douloureuse.

Un nouveau diagnostic simplifié est décrit, par la pression sur les ligaments sacro-iliaques postérieurs. Le diagnostic est confirmé par l'anesthésie locale du ligament qui supprime ou diminue la douleur.

Les états aigus peuvent être soulagés par l'injection d'un anesthésique local à effet prolongé. Les lésions articulaires avec relâchement ligamentaire peuvent être guéries par la sclérothérapie.

L'injection d'une solution sclérosante

tendons de lapins ont provoqué
issus fibreux et ont augmenté le
des tendons de 40 p. 100 par rap-
animaux de contrôle. L'augmen-
la force est d'environ 100 p. 100.
lades atteints d'affection du liga-
ro-iliaque postérieur ont été trai-
s 82 p. 100 des cas la guérison a
s de 14 ans. Sur environ 2500
s il n'y a eu aucun accident. Quel-
typiques sont décrits.

### RIASSUNTO

ioni da stiramento dell'articola-
ro-iliaca si verificaodi frequente,
on vengono diagnosticate e, come
ssono dare un rilassamento per-
del ligamento sacro-iliaco poste-
rilassamento del tratto prossimale
ento sacro-iliaco posteriore viene
iagnosticato come uno stato pato-
lla regione lombo-sacrale poichè
spinosa della V lombare scende
vello più basso del margine supe-
l sacro. La localizzazione esatta
na dolorosa consente di porre la
differenziale. Viene descritto un
metodo diagnostico che consiste
mpressione sul ligamento posteri-
o-iliaco. La diagnosi può essere
ata coll'infiltrazione novocainica
mento che attenua o fà cessare il
Gli stati acuti della malattia pos-
ere curati coll'infiltrazione del liga-
acro-iliaco posteriore mediante an-
locali ad azione ritardata. Quando
lassamento del ligamento si può
ne la terapia sclerosante. L'inie-
i sostanze sclerosanti nei tendini
glio produce una proliferazione di
ivo con un aumento del diametro
line del 40% e della sua resistenza
%. Sono stati curati 432 casi di
del ligamento sacro-iliaco posteri-
ell'82% dei casi si sono attenute
guarigioni durevoli fino a 14 anni. Nessun incidente in 2500 iniezioni circa. Presentazione dei casi più dimostrativi.

### SUMARIO

A lesão de arrancamento dos ligamentos da articulação sacro-ilíaca ocorre freqüentemente, muitas vêzes não é diagnosticada, e pode resultar em permanente relaxamento do ligamento sacro-ilíaco posterior. Relaxamento da porção superior do ligamento sacro-ilíaco posterior é freqüentemente diagnosticado como distúrbio lombo-sacro porque a espinha pósterosuperior da 5ª vértebra lombar se estende caudalmente para o sacro, e a sensibilidade lateral à esta depressão está acima da porção superior do ligamento sacro-iliaco posterior. A determinação da área da dôr referida auxilia o diagnóstico diferencial.

Um novo método simplificado de diagnóstico é descrito, baseado na pressão sôbre os ligamentos sacro-ilíacos posteriores. O diagnóstico é confirmado pela infiltração dos ligamentos com anestésico local e abole ou alivia a dôr.

Condições agudas podem ser aliviadas pela infiltração do ligamento sacro-ilíaco posterior com uma solução anestésica de longa duração. As lesões articulares, nas quais resulta o relaxamento dos ligamentos, podem ser curadas pela escleroterapia.

A injeção de substância esclerosante em tendões de coelhos determina a produção de néo-tecido fibroso ae permanente aumento do diâmetro do tendão em 40% dos casos. O aumento da resistência é aproximadamente de 100%.

Quatrocentos e trinta e dois pacientes com distúrbios relacionados com o ligamento sacro-ilíaco posterior foram tratados. Curas observadas até 14 anos foram obtidas em 82% dos casos. Nenhum incidente desfavorável ocorreu em cêrca de 2.500 injeções. Casos ilustrativos são

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> It is perhaps a natural human impulse to view with horror and disgust all manners and customs different from those to which we are used. Ants and savages put strangers to death. And those who have never traveled either physically or mentally find it difficult to tolerate the queer ways and outlandish beliefs of other nations and other times, other sects and other political parties. This kind of ignorant intolerance is the antithesis of a civilized outlook, and is one of the gravest dangers to which our over-crowded world is exposed. The educational system ought to be designed to correct it, but much too little is done in this direction at present.
>
> —*Russell*

# Differential Diagnosis and Treatment of Lesions of the Cervix

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A NEW era in gynecologic therapy was begun in 1893 and 1896, when Strogonoff and Winters announced their theory that acute and chronic cervicitis was a distinct entity.

Chronic endocervicitis[1] marked the beginning of the modern rational treatment of cervicitis. Thus a new era in gynecologic therapy, the era of local treatment of the diseased cervix and consequent relief of its symptoms, was begun.

One cannot stress too much the importance of proper diagnosis and treatment of the medical condition, when one realizes that 85 per cent[2] of women suffer from one or more pathologic conditions of the cervix, endocervicitis being the most common.

The importance of care of the cervix is again emphasized when one realizes that it is the third most common causative factor in systemic infection[3] — tonsils and teeth leading the list, in that order.

Until the "how and why" of cervicitis is clearly understood, there will be little, if any, change from the present methods of treatment. A clear understanding of the anatomic, histologic and pathologic nature of the cervix is fundamental. There is no other approach to rational treatment.

Anatomically the cervix is divided into three portions: the supravaginal, the intermediate and the vaginal. More popularly, the three portions are determined by the external os, the internal os and the isthmus (at which point the circular artery furnishes the blood supply). There are no sinuses in the cervix similar to those observed in the uterus.

The cervix receives its blood supply through one or two sets of arteries branching from the uterine arteries. The cervical arteries, owing to a heavy layer of elastic tissue, are thicker than those of the fundus. The veins are fewer, having no large venous sinuses. The venous circulation, which has no valves, anastomoses with that of the vagina and the bladder and empties into the uterine vein.

The lymph vessels of the cervix form an intimate network with those of the fundus, the base of the bladder and the parametrium. They penetrate every bundle and fascili of the entire uterine musculature, draining into larger channels which course parallel to the uterine and ovarian blood vessels. They connect with the sacral lymphatics via the uterosacral ligaments. A wide ramified anastomosis with the base of the bladder and the posterior portion of the vagina explains the ready spread of inflammation and metastases to adjacent areas. There is a difference of opinion as to whether bacterial infection spreads by continuity of surface, the blood stream or the lymphatics. Regardless of the manner in which this takes place, it is a fact that primary infection of the cervix may ascend into the uterus, fallopian tubes, ovaries and parametrial tissues.

The external [illegible] proximately 5 mm.

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From the A. M. Hansen Professional Group, Los Angeles, California.
Read in Copenhagen, Denmark, and at a meeting of the California Medical Association, by Dr. Hansen.
Submitted for publication June 15, 1954.

in its transverse diameter. It is covered by stratified squamous epithelium. After pregnancy, infection, instrumentation, trauma or disease the os may be distorted, enlarged or lacerated. The internal os is circular, approximately 1 mm. in diameter, and rarely changes its definite shape. The cervical canal, approximately 1 inch (2.5 cmm.) in length, is fusiform or spindle shaped. It is lined by mucus membrane, which is about 1 mm. thick, and from which a large number of folds or rugae (plicae palmatae) branch obliquely or laterally. Owing to the numerous folds and plications, this relatively small surface is increased in actual area, presenting an extensive surface that is susceptible to infection.

The epithelium at the isthmus is of the low columnar or cuboidal variety; advancing toward the external os, the epithelium becomes of the high columnar, ciliated variety, about 40 by 4 mu., with a constant basement nucleus. At or about the juncture of the middle or lower third of the cervical canal the epithelium undergoes transition to the stratified variety. Scattered throughout are numerous simple tubular glands. As the ducts open into the cervical canal and approach the internal os, the glands become fewer. It is here that this structure becomes a ready point of access for infection following trauma of any sort.[4]

Cervicitis may be classified first as (1) benign, acute and chronic[5]; (2) precancerous, with severe chronic endocervicitis and leukoplakia, and (3) malignant, in which the lesions, which fall into the following three types: carcinoma *in situ*, early invasive squamous cell carcinoma type, and adenocarcinoma.

The most frequent symptoms reported are leukorrhea, backache and pain in the lower part of the abdomen. Less frequent symptoms are menorrhagia, metrorrhagia, dyspareunia, dysmenorrhea, pruritis, dysuria and sterility.

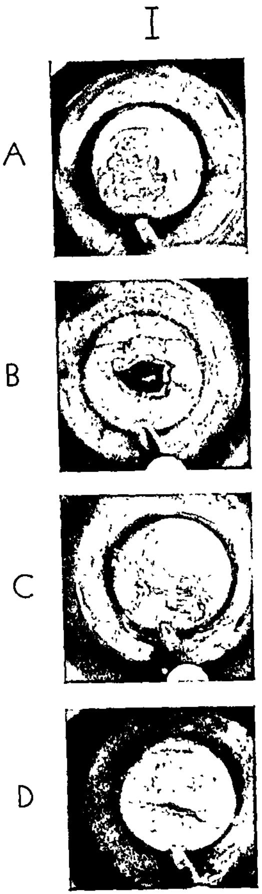
Most benign lesions differ essentially in degree. Acute lesions with their ever-present infections — trichomona, monilia, tuberculosis, syphilis, gonorrhea and mixed streptotoccus-staphlococcus infection—will only be mentioned here. Chronic lesions, however, may be of the following types: tuberculosis, which is generally secondary to tuberculosis of the tubes, is infrequent; erosion with laceration or ectropion (Plate I-A); infected lacerations, which may be of postpartum or instrumental origin; and, finally, endocervicitis, with chronic inflammation of the nabothian cysts.

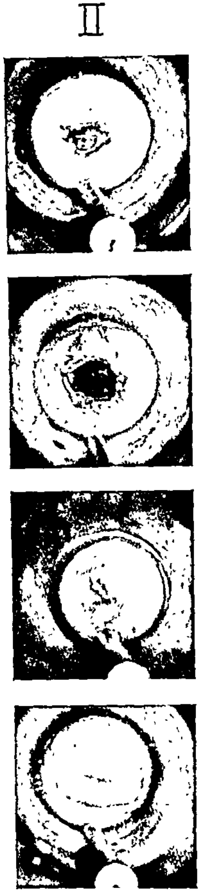
Acute lesions of the cervix can be dispensed with in a few words. All those which do not respond to medical treatment in a few weeks come under the heading of "chronic lesions." Gonorrhea today, treated by the administration of antibiotics, is not the problem that it formerly was; this may also be said of most mixed infections. Moniliae and trichomonae come under another classification, and therefore will not be mentioned here. This, then, brings us to the chronic precancerous and cancerous lesions, which present the most serious problem.

The differential diagnosis[6] of lesions of the cervix is of paramount importance to the patient. Any condition that leads to exposure of the mucus glands in the endocervical canal predisposes to chronic low-grade infection. It is for this reason that we stress again the point that all physical examinations should be thorough as to history, laboratory procedures, and especially breast and vaginal examinations of all female patients. Irrespective of whether the patient has any vaginal complaints, an examination is not complete without thorough vaginal investigation. We are glad to say that this is being done routinely now, much more so than five, ten or fifteen years ago.

It has been our experience that many severe cervical erosions, polyps and early carcinomas of the cervix (Plate II-A) have been diagnosed as a result of routine pelvic examinations, in spite of the fact that the patient did not have any symptoms referable to the pelvis.

The most common chronic cervical (benign) lesions are due to erosions from congenital defects and to erosions caused





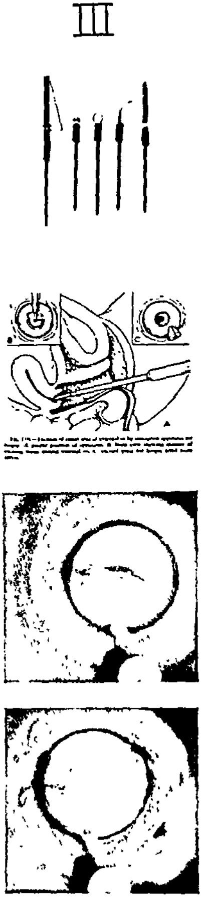


Plate I.—A, ectropion with erosion, before treatment. B, C, and D, condition ten days, four weeks and six weeks, respectively, after electrosurgical conization. At four weeks (C) healing is in progress; in D, taken six weeks after the conization treatment, the area has healed.

Plate II.—A, severe erosion and polyp, before treatment. B, C and D, condition after electrosurgical conization. C and D, condition three weeks and six weeks, respectively, after the conization treatment. At three weeks (C) healing is in progress; at six weeks (D) the area is healed.

Plate III.—A, instruments for electrosurgical conization. B, technic and use of the instruments. C, squamous cell carcinoma, Stage II-III; treated surgically in 1948, with a six-year cure. D, squamous cell carcinoma, Stage III; treated surgically in 1947, with a seven-year cure.

by injury consequent to parturition. Especially is this true of lacerations which have not been properly repaired at the time of delivery. In the majority of cases the cervix is lacerated during parturition. These lesions usually heal, but some become infected and secondary inclusion or nabothian cysts result. These cysts occur commonly. Frequently they contain mucus only, but in many instances they are infected. Their glandular structure may be very deep.

Chronic mycotic endocervicitis usually is an extension of the disease from the vagina. Frequently the condition is acute, evidenced by red inflamed membranes involving the entire vagina and cervix. A presumptive diagnosis is usually confirmed by the demonstration of yeast buds and mycelia by smear or culture.

Endocervical polyps are frequently present at the external os as soft, granular, movable, pedunculated outgrowths that tend to bleed readily on manipulation. They are covered with columnar epithelium, which demonstrates their origin from *within* the external os. If they are not wholly removed at the base of the pedicle, recurrence can be expected. This is best done by cold knife biopsy or snare, followed by wide electrosurgical conization.

Precancerous lesions must be differentiated from chronic cervicitis or true carcinoma by Papanicolaou slide and cold *knife biopsy, followed by high frequency* electrosurgical cutting current conization.

Leukoplakia of the cervix[7] is more common in older women. It is considered a precancerous lesion[8] and should be given immediate attention. Following diagnosis, large doses of Vitamin A (250,000 to 500,000 units daily) and hormone therapy *(50,000 units twice weekly)*[9] *are indicated,* provided the condition is benign. Achlorhydria may be present. Meigs believes that cancer arises only in tissues which have become altered by irritation. Thirty-nine per cent[2] of all women who reach the age of 35 years have cancer of the cervix.

Carcinoma *in situ*,[10] or Grade "O" in the *International Classification, is apparently* confined to the surface epithelium as a noninvasive growth. This tumor *in situ* is impossible to diagnose by gross examination. The lesion is curable, as is all early carcinoma, so we again advise careful pelvic examination, Papanicolaou slides and cold knife biopsy encircling the entire endocervix, followed by electrosurgical conization—some recommend total hysterectomy.[11]

Early invasive carcinoma may be distinguished at pelvic examination from benign granulations. There is induration; the tissues are firm, and there is a tendency to bleed readily on slight trauma. The diagnosis must be confirmed by early thorough biopsy, followed by electrosurgical conization and microscopic examination.

Advanced malignant disease takes the form of a cauliflower growth,[4] often covered with a dirty slough that breaks away, causing bleeding and hemorrhage. However, the growth may reach a late stage of stromal invasion by submucus extension and yet be associated with only a minimal amount of surface involvement. *Again, a plea for adequate pelvic examination,* cold knife biopsy, followed by electrosurgical conization and microscopic diagnosis, is in order (Plate III-B).

Owing to the expense and the lack of hospital beds, we have found that this procedure can be carried out satisfactorily in our clinic, which is equipped with a *complete surgery and a staff* of nurses. Prior to the day of operation, a complete history is taken and a complete physical examination made. We also include a complete blood count and urinalysis. The patient is instructed to report to the office on the morning of operation without having taken anything by mouth since mid*night.* She is put to bed and given preoperative medication, after which she is catheterized and prepared for the operation with Phisohex. The anesthetic of choice is sodium pentothal, administered by a physician anesthesiologist.

In our experience, the only satisfactory and conclusive method of taking a biopsy specimen from the cervix is to remove a coned area of the [illegible] means of a sharp, pointed scalpel, excising a circular area of the cervix that includes the entire diameter. This permits removal of a circumscribed area of pathologic tissue and also includes adjacent normal cervical tissue. Thus, on microscopic examination, the pathologist has the advantage of studying not only the superficial squamous glandular structure but the endocervical portion, which is lined by columnar cells. The entire circumference of the squamous columnar juncture is therefore included in the biopsy. After removal of this specimen there is necessarily considerable bleeding, because of the extensive vascular supply to the cervix. With use of a radio knife and a tubecutting current, this bleeding is easily and satisfactorily controlled by electrosurgical conization.[12] One may use a combination of the cutting current and the coagulation current in cases of persistent oozing. In a few cases of continued bleeding the ball electrode may be used (Plate III-A). In many instances nabothian glands will be present at a considerable distance from the os. These may be coagulated, or the remainder of the ectropion may be removed by superficial coagulation with the ball point. Often a long extension needle is used deep into the base of the gland. After electrocoagulation the cervix is packed with iodoform gauze. This acts as a deodorant and bleeding control. It is usually removed within twenty-four to forty-eight hours after the operation, but it may be left in for five days or more. For intractable bleeding the vessel may be sutured with No. 00 catgut.

After electrosurgical conization the patient is transferred to bed and carefully checked by the nursing staff. After recovery from the anesthetic, usually four to six hours after the operation, she may be transported home via automobile. She may have bathroom privileges and be up as tolerated. She returns to the office two or three days after the operation for removal of the iodoform gauze.

As a rule, our patients do not require any postoperative medication. They are advised against douching for two weeks. Follow-up examinations are done at regular intervals. In an occasional case it may be necessary to use dilators in the cervix if the patient has any difficulty at her menstrual period.

During pregnancy all biopsy specimens should be taken with the punch biopsy forceps, with the exception of the delivery specimens. These are taken with scissors, a V-shaped portion of tissue being obtained. The area is closed with figure-of-eight sutures.

Meigs stated, "From the findings in 100 consecutive cervices biopsied, there is no indication that pregnancy should lead to serious errors in diagnosis" (Rubin). Cancer of the cervix in pregnancy, whether intraspithelial or invasive, is not histologically different from the same lesion in the nonpregnant uterus. The opinion held by many that intraepithelial carcinoma in pregnancy is a reversible lesion is completely lacking in proof.[1]

Intraepithelial carcinoma in either the pregnant or the nonpregnant uterus demands examination of the entire cervix for proof of noninfiltration. The coexistence of carcinoma *in situ* and invasive carcinoma is entirely too frequent to be ignored.

## SUMMARY AND CONCLUSIONS

From 1947 to 1954, 165 patients have been treated with the routine advised in this paper. Of these, 87 patients have been treated and followed in the office. In 3 cases carcinoma was diagnosed by biopsy and treated by panhysterectomy and gland dissection. The 3 patients have had from five-year to seven-year cures and are well at the time of writing.

The treatment of carcinoma of the cervix is both impressive and depressing. Good results with irradiation may be happy ones, but the failures are most depressing and disturbing. The majority of carcinomas of the cervix discovered todays seem to be in Stages 3 and 4. Few of these will be cured by any treatment.

The minority are in clinical Stage I, apparently limited to the cervix, where irradiation causes five-year arrest in approximately 60 per cent. Total hysterectomy, with removal of the adnexae and thorough lymph gland dissection, appears to give the best results today. This operation is now possible, owing to the improved knowledge and technics of anesthesia, antibiotics, electrolyte balance, blood transfusions and sulfa drugs, in addition better trained and more meticulous surgeons.

Better and more thorough examinations and better education of the public are needed. This may be accomplished by continued training of women to seek routine pelvic examinations. Biopsies of all eroded areas and leukoplakic areas of the cervix should be done. Preferably repeat cold knife biopsies are done when indicated, with removal of a wide margin of normal tissue. Well-trained pathologists are needed to evaluate biopsies and Papanicolaou smears. Papanicolaou smears should be repeated as indicated. The treatment and care of cervicitis should be by electrosurgical conization, amputation or total hysterectomy when indicated. Carcinoma *in situ* should be treated by total hysterectomy. Attempts should be made to discover all cancers in Stage I, at least. Diagnosis should be made at this stage, and the vast number of carcinomas of Stages 3 and 4 should be eradicated by an extensive campaign.

Careful and expert irradiation therapy[1] and colloidal gold treatment[13] may be employed in individual cases. Determination of irradiation sensitivity by repeat biopsies, cervical smears and pelvic examinations must be done. Radical operation, which includes, whenever possible, panhysterectomy and extensive meticulous gland dissection and resection, should be done.

### RÉSUMÉ ET CONCLUSIONS

De 1947 à 1954, 165 malades ont été traitées selon la méthode recommandée par l'auteur. 87 ont pu être suivies et traitées ambulatoirement. Dans 3 cas la biopsie a révélé un carcinome; traitement: hystérectomie totale avec dissection des ganglions lymphatiques. Le traitement a été poursuivi durant 3 à 5 ans, et ces 3 malades sont actuellement bien portantes.

Le traitement du carcinome du cervix est à la fois impressionnant et décourageant. L'irradiation peut donner de bons résultats, mais les échecs sont des plus déprimants et troublants. La majorité des carcinomes du cervix diagnostiqués aujourd'hui semblent appartenir aux stades 3 et 4. Peu d'entre eux réagissent favorablement à un traitement quelconque. Les plus rares appartiennent au stade I, apparemment limité au cervix, où l'irradiation provoque un arrêt de développement de la tumeur dans environ 60 % des cas durant cinq ans. C'est l'hystérectomie totale avec exérèse des annexes et dissection des ganglions lymphatiques qui paraît donner les meilleurs résultats.

### RESUMEN Y CONCLUSIONES

Desde 1947 a 1954, se han tratado 165 pacientes con la rutina que se aconseja en este artículo. De éstos, se trataron 87 pacientes que se controlaron en el consultorio. En 3 casos se diagnosticó carcinoma por biopsia, habiéndose tratado por panhisterectomia y vaciamiento ganglionar. Los 3 pacientes han tenido curas de cinco a siete años y se encontraban bien en el momento de escribir este artículo.

El tratamiento del carcinoma del cérvix es impresionante y deprimente. Los buenos resultados con irradiación pueden ser felices, pero los fracasos son muy deprimentes. La mayoría de los carcinomas del cérvix, parecen ser actualmente grado 3 y 4. Unos pocos de éstos curan por cualquier tratamiento, la minoría se encuentran en grado clínico 1, limitados aparentemente al cérvix en donde la irradiación produce una detención de cinco años en el 60 por ciento aproximadamente. La histerectomía total con extirpación de los anexos y disección de los ganglios linfáticos, parece ser lo que proporciona los mejores resultados actualmente. [illegible] ta o [illegible] ion es a [illegible] ble, [illegible] oria

conocimiento de la anestesia, antibióticos, balance electrolítico, transfusiones sanguíneas y sulfas, ésto sumado a cirujanos mejor entrenados y más meticulosos.

### CONCLUSIONI RIASSUNTIVE

Dal 1947 al 1954 sono state curate 165 malate. In 3 di esse si fece diagnosi di carcinoma, con biopsia, e furono sottoposte ad isterectomia totale con asportazione delle linfoghiandole. Tutte 3 sono state seguite e trattate per 5-7 anni e stanno bene. La cura del cancro del collo è duplice: con l'irradiazione si possono ottenere buoni risultati, ma si hanno degli spiacevoli insuccessi. La grande maggioranza dei carcinomi cervicali diagnosticati appartiene allo stadio 3° o 4° ben pochi di essi hanno probabilità di guarigione. Un piccolo numero appartiene al 1° stadio (le lesioni sono circoscritte alla cervice) e può essere arrestato quasi sempre con la terapia radiante. Attualmente i migliori risultati si ottengono con l'isterectomia totale e l'asportazione completa dei territori linfatici, intervento reso possibile dai progressi della anestesia della terapia pre e post-operatoria e dalla perfezione della tecnica.

### ZUSAMMENFASSUNG UND SCHLUSSFOLGERUNGEN

Von 1947 bis 1954 wurden 165 Patientinnen mit der in der vorliegenden Arbeit empfohlenen Methode behandelt. Von diesen wurden 87 in der Sprechstunde behandelt und weiter verfolgt. In drei Fällen wurde mittels Probeexzision ein Karzinom festgestellt und eine totale Resektion der Gebärmutter und der Lymphdrüsen vorgenommen. Diese drei Patientinnen wurden 5 bis 7 Jahre lang beobachtet und befanden sich zur Zeit der Niederschrift dieser Arbeit in gutem Zustand.

Die Behandlung des Karzinoms des Gebärmutterhalses ist gleichzeitig eindrucksvoll und deprimierend. Bestrahlungen mögen zu erfreulichen Resultaten führen, ihre Versager sind aber äusserst deprimierend und verwirrend. Die Mehrzahl der heutzutage diagnostizierten Zervixkarzinome scheint dem dritten und vierten Stadium anzugehören. Von diesen können nur wenige geheilt werden, gleichgültig welche Behandlung angewandt wird. Nur eine Minderzahl wird im ersten klinischen Stadium, d.h. offenbar auf den Gebärmutterhals begrenzt, entdeckt; in diesen Fällen erzielt die Bestrahlungsbehandlung einen fünfjährigen Stillstand der Krankheit in etwa 60 Prozent. Die totale Gebärmutterresektion mit Entfernung der Adnexe und sorgfältiger Präparierung der Lymphknoten ergibt heutzutage offenbar die besten Resultate. Dass diese Operation heute möglich ist, verdanken wir den Fortschritten in der Anästhesiologie und dem besseren Verständnis der Antibiotika, des Elektrolytengleichgewichts, der Bluttransfusionen und der Sulfamine sowie der besseren Ausbildung der Chirurgen.

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# Pollicization of the Ring Finger

ROGER LETAC, M.D., F.I.C.S.

DAKAR, FRENCH WEST AFRICA

WHEN the two phalanges of the thumb are partially or totally amputated, if there remains a piece of the metacarpal bone, plastic reconstruction (utilizing a tube of skin covering a bone graft) can give a satisfactory result. It presents, nevertheless, some disadvantages: repeated surgical intervention over a long period, lack of normal sensation in the new thumb, risk of nonunion of the graft (which is held on one side only), and total lack of movement of the member (if the graft is set in the metacarpal). Nevertheless is permits solid opposition, though it is really a living prosthesis rather than a new thumb.

More satisfactory is pollicization of the second finger, which preserves all or part of the normal sensation of the finger. Furthermore, the vascularization being normal, repair and adaptation take place under the best conditions. It results in a sensitive finger, with good circulation and good mobility which are not limited to the carpometacarpal articulation alone.

Unfortunately, pollicization of the index finger has a certain number of drawbacks. The scar is badly located and can be troublesome; the innervation of the internal border is sometimes sacrificed; it is often difficult to place the finger in good opposition; the finger is too long, and sometimes the distal phalanx must be removed, and, finally and most important, the operation deprives the hand of a capital finger, the index, which gives the hand its cleverness and guides prehension. An operation for transportation that produces an imperfect thumb should certainly not interfere with the function of the other fingers. In addition, the function of the middle finger is abolished, this finger losing its property as "strength finger" to become a poor index.

For the same reason there is no question of using the middle finger. The operation of Hilgenfeld, which transposes this finger by an incision of the commissure (of which I have learned since the publication of my observations), is not preferable to pollicization of the index. As for the little finger, it is indispensable in assuring the width of the palm and full prehension.

Its use as a sort of thumb, in a very special case, has caused me to consider pollicization of the fourth finger, which serves as an auxiliary to the middle finger.

The fourth is the least useful of all the fingers; its loss results only in minimum functional impairment of the hand. In Case 1 I worked with Prof. Merle D'Aubigne, who corrected defects left by the first operation:

## REPORT OF CASES

CASE 1.—T. R., a soldier, showed a mutilation of the right hand involving amputation of the thumb and the index finger, including their metacarpals, and amputation of the three phalanges of the middle and ring fingers; only the little finger was intact, together with the third and fourth metacarpals and the multangulum. The idea occurred to me that this otherwise useless finger might be used to create a sort of thumb apable of giving opposition to i he palm. To do this I made
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depriving the neigh

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Professor of Tuyery University, Dakar.
Submitted for publication July 6, 1954.

vascularization and innervation. The operation, performed on July 15, 1946, with the patient under general anesthesia with balsoforme, at the Hospital complementaire "clinique Moderne," was as follows:

1. The little finger was disarticulated, with *preservation of its neurovascular pedicles*, through a dorsal incision, and section of both extensor and flexor tendons was performed.
2. The multangulum bone was uncovered by an incision on the lateral aspect of the hand.
3. A tunnel was made under the palmar aponeurosis with blunt scissors and "bougies de Hegar." Through this the finger and its pedicle were passed, to emerge close by the multangulum.
4. The base of the phalanx of the little finger was sutured with catgut to the multangulum bone.
5. Through an antibrachial incision, the flexor tendon of the thumb was found and sutured to the deep flexor tendon of the little finger. (This had to suffice for flexion, opposition being obtained by the superficial flexor tendon.)
6. The skin was closed.

The immediate result was perfect with regard to circulation and sensation in the new thumb, but opposition was feeble, for the rotation of the finger on the multangulum was insufficient. Prof. Merle D'Aubigne operated later to correct the rotation. The wounded soldier thus obtained, in spite of his severe mutilation ,a perfectly useful hand.

This case gave me the idea of using the method, not with the little finger, but with the ring finger, the least indispensable of all. Each time that I have seen a hand deprived of its thumb with all or part of the metacarpal, and with a sound index, I have transplanted the fourth finger to the place of the thumb, thereby leaving to the middle and index fingers their normal function. I have done 7 such operations on 6 different patients, in 1 of whom the condition was bilateral.

CASE 2.—A man 30 years old (Kaboul) had lost the left thumb, with its metacarpal. The middle, ring and little fingers had each lost one phalanx; the index was intact. Everything was against its use as a new thumb.

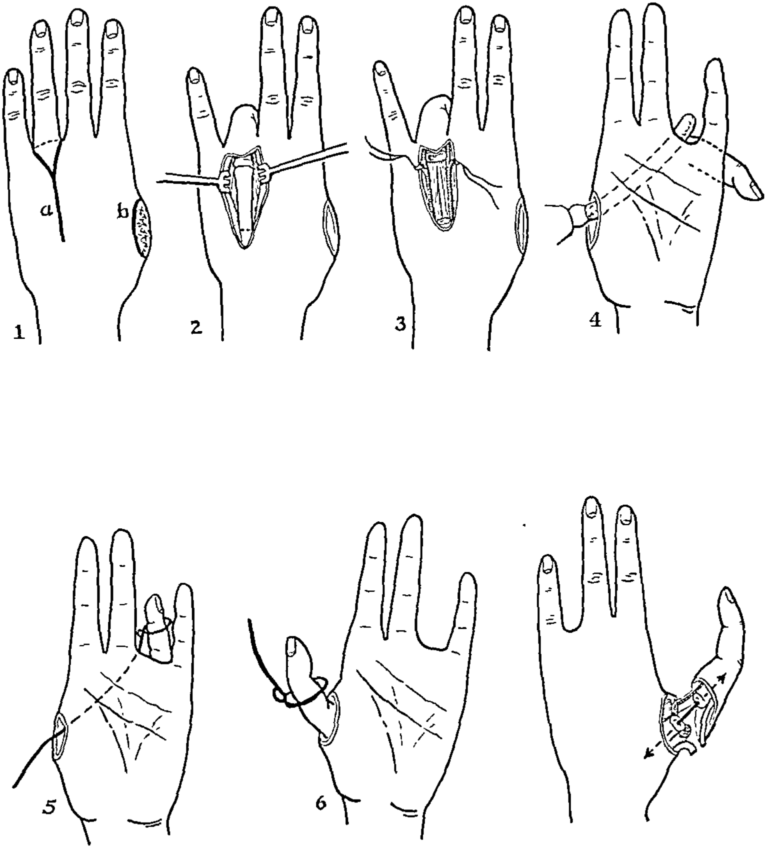
On Nov. 25, 1948, with the patient under general ether anesthesia, the ring finger was transposed to the place of the thumb. The metacarpal of the fourth finger was divided at its proximal third and attached to the multangulum. The muscles of the thenar eminence were sutured to the point of insertion of the interosseus muscles, and the extensor tendon of the finger to the abductor and to the *extensor of the thumb.* The metacarpal of the new thumb was thus formed by two-thirds of the ring finger metacarpal. The new thumb was carefully watched. The dressing was changed on the fifth day (see photograph), and mobilization was begun. After two months the recovery of joint motion was complete. Abduction and opposition was possible, though limited (the patient could take objects varying in diameter from a pencil to a flask of 200m3 200 c. mm. capacity). Flexion was less perfect, but prehension was strong enough to make is difficult to tear away what the patient held.

CASE 3. (Expeditionary Corps in Far East).—A man 22 years old had lost a thumb and two-thirds of the first metacarpal. The other fingers were intact and their function complete.

The ring finger was transposed, with disarticulation of the carpometacarpal and division of the fourth metacarpal in its middle. The pedicle was dissected and extensor tendon divided. The finger was passed under the palmar aponurosis and the metacarpal solidly attached, by a bone peg taken from the cut end, to what was left of the first metacarpal. The abductor and extensor tendons of the thumb were sutured to the extensor of the ring finger. The skin was closed.

Unfortunately a plaster cast that was too tight endangered the vitality of the new thumb during the following days. Repeated stellate blocks and refrigeration of the finger saved it from ischemia, but the skin sloughed at different points. Sensation was recovered, but slowly. After two months abduction and opposition were satisfactory, but flexion of the phalanges remained limited. Function was good; the patient could make many precise movements (writing) and strength motions (take between thumb and index a heavy bottle, tear a sheet of paper by pulling) and motions requiring both precision and strength (*uncork a bottle, lace his shoes*).

CASE 4. (Expeditonary Corps in Far East).—A girl 18 years old had been wounded by the bursting of two grenades in her hands. The right hand had lost its thumb completely, including the metacarpal and the multangulum: the thenar eminence was destroyed. The



Sketch of author's technic: *1*, the incisions (*a*) for exarticulation of the fourth finger with its metacarpal, and (*b*) for excision of the scar at the site of the lost thumb; *2*, exposure, freeing of the fourth metacarpal bone and exarticulation of the finger; *3*, resection of the fourth metacarpal bone; exposure of the arterial tract and section of the collateral branches for the fifth and third fingers between ligations; *4*, determination of the necessary subaponeurotic passage for the fourth finger; *5*, anchorage of the fourth finger with a heavy silk thread; *6*, traction on the silk to bring the fourth finger into the place of the third; *7*, insertion of an intramedullary iron peg to unite the bones. The extensor tendon of the thumb is sutured to that of the fourth finger. The thenar muscle is sutured onto the interosseus muscle.

ring finger had lost the distal phalanx. The left hand was not so severely injured. The thumb was missing, together with its metacarpal. Both hands, especially the right, were full of small grenade fragments.

The left hand was treated first. Pollicization of the ring finger with the distal half of its metacarpal was done first and was followed by an abdominal skin plasty. In a second operation, three weeks later, a skin plasty was done to cover the denuded area on the lateral aspect of the right hand. Finally, in a third operation, pollicization of the ring finger of the right hand was done by planting the metacarpal of the new thumb directly into the navicular bone.

On the left hand the results were quite satisfactory so far as abduction and opposition were concerned; flexion, though very limited, was achieved. On the right hand there was only little return of motion. The patient was removed from my jurisdiction before healing was complete.

CASE 5. (Expeditionary Corps in Far East).—A man 30 years old had lost the right thumb and its entire metacarpal. The other fingers were intact. The wound was two months old.

In the first stage of treatment preparation by an abdominal skin plastic was done, with division of the pedicle fifteen days later.

In the second stage pollicization of the ring finger was performed. The distal half was planted in the multangulum. There was normal healing, with good opposition and abduction, but flexion of the phalanges was rather limited.

CASE 6.—A man 32 years old had lost the left thumb and two-thirds of its metacarpal. The other fingers were intact, but there was extensive loss of substance of the palm and thenar eminence. The wound was more than three months old.

Pollicization of the ring finger and a skin plastic were done at the same time. The fragment of the first metacarpal and the first phalanx of the ring finger (the base of which had been resected) were stabilized by a pin, which also held the second phalanx in the right position, to overcome the strong pull of the flexor tendon.

There was normal healing, but in spite of the pin there was persistent flexion contracture of the second phalanx. Opposition was good, abduction was limited and flexion weak. The transplanted finger had a natural appearance, was warm and had good sensation.

CASE 7. (Dakar).—A man 40 years old had lost the right thumb and two-thirds of its metacarpal. The other fingers were intact.

Pollicization of the ring finger was done. As the patient was a mechanic and needed a large, strong hand, I undertook to preserve the fourth metacarpal and a fragment of the proximal phalanx, to save for the palm its maximum width. Unfortunately, dissection of the pedicle through a dorsal approach was hampered by the metacarpal, so that the pedicle was too short. This resulted in excessive angulation and traction on the pedicle. Curiously, the new thumb bled normally after the operation. It did not slough, so to speak, but dried up during the next three weeks. Part of it had to be amputated. There remained a sufficiently long stump to provide an apparatus that was of some use. Nevretheless this failure was certainly due to my overzealousness in attempting to achieve a perfect result.

It is thus evident that, in 8 cases of transposition of one finger with its neurovascular pedicle and tendons through the palm, I have had 1 complete failure, 1 threat of necrosis of the transposed finger stopped by stellate block, and 6 new thumbs that have remained healthy. It is to be noted that the finger threatened by necrosis later became normal. As to the danger of sloughing, it is my opinion that if one takes precautions it is not to be feared: the two casualties were due to technical errors. In 1 case the finger was placed in a plaster cast that was too tight; in the other I had tried to preserve the metacarpal instead of cutting it, to obtain a wider opening. In none of the other cases have there been any complications. Sensation was normal; the finger was warm and looked perfectly sound; sometimes it was difficult to realize that it was not the genuine thumb. In 3 cases cutaneous plastic procedures were necessary to cover the loss of substance of the palm, or to form a commissure.

Observation of the results as to motion revealed that, although opposition and abduction were usually good, flexion and extension were often limited. There was frequent flexion contracture due to the necessity of cutting the extensor of the finger and suturing it to the thumb extensor, which seemed insufficiently strong to counterbalance the two powerful flexors; even with the suture done in forced extension, flexion contracture appeared later. This could possibly have been avoided by the use of the superficial flexor as a replacement for the opponens, in case the thenar eminence were lacking. Perhaps the use of the longer trail for the flexor tendons forces this retraction. When one uses the first phalanx of the ring finger as the metacarpal of the new thumb, it might be better to cut the pulley of the first phalanx. I have not totally clarified this important question.

In any case, I can suggest the following scheme:*

A. In case of sufficient segment of the first metacarpal, with conservation of the thenar eminence:

1. Under general anesthesia and bloodless field make a racket incision and perform the palmar strip disarticulation of the finger with its metacarpal.

2. Section the extensor tendon over the middle third metacarpal.

3. Perform subperiosteal dissection of the metacarpal, followed by severance of the metacarpal at the previously determined level.

4. This gives a wide view of the intermetacarpal space where, now, will be dissected the two neurovascular bundles. These bundles will be isolated as high as possible in the palm. The vessels are freed by the section of the collaterals of the middle and the little fingers. Concerning the nerves, the nervous fibers will be separated up to the origin of the digital nerve. Of course the dissection must not be done too close and must not free the sides of the vessels and nerves near the finger axis. The flexor tendons are freed forward. Thus one obtains a neurovascular and tendinous pedicle which insures motion, nutrition and sensation to the transposed finger. The tourniquet is released and hemostasis obtained with care.

5. Excise the scar of the thumb amputation and prepare the place for the new thumb by smoothing the remaining fragment of the first metacarpal.

6. Pull the ring finger through the opening between the palmar aponeurosis and the flexor tendons of the middle and second fingers. To do this one must drill carefully, with the bunt scissors, alternately cutting and separating, a tunnel under the aponeurosis, going obliquely from the upper part of the palm to the external wound and passing within and in front of the thenar eminence. Once obtained, this tunnel is widened by the use of a proportioned "bougie de Hegar." Hemostasis is then carefully established.

7. With the help of a strong silk suture tightened about the end of the freed finger, pull this finger through the tunnel, avoiding twisting of the pedicle. The finger, once in place, will have rotated 100 degrees on its longitudinal axis and taken a perfect position of opposition; this is due to the fact that such a rotation gives the pedicle its ultimate length.

8. At the length necessary to avoid traction on the pedicle, cut the proximal phalanx of the fourth finger and consolidate the remaining fragment of the first metacarpal with the phalanx of the transposed finger by some means of internal fixation (for instance, a centromedullary pin). One can use the tenon system suggested by J. Gosset, though in this case the derotation of the new thumb is natural.

9. Finally, suture the extensor tendon of the fourth [illegible] remains of the extensor [illegible] as possible [illegible]

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*For further details see the new edition of Dr. Marc Iselin's "Surgery of the Hand: Surgeon's Book," Paris, Mason et Cie, 1954.

the finger placed in forced extension. The abductor of the thumb will be sutured to the appendices musculotendinous externe of the fourth finger, formed by the interosseus and lumbricals. The thenar muscles *will be sutured* to the interosseus and the lumbricals internal, after more or less high division along the lateral border of the proximal phalanx. These sutures will be done with steel thread. Then one closes the wound resulting from removal of the fourth finger and its metacarpal after having taken the precaution to suture, with nonabsorbable thread, what remains of the third and fifth intermetacarpal ligaments. The skin is then sutured and the hand placed in a small plaster cast to maintain the new thumb in extension, but without squeezing it, and leaving free the tips of the fingers and the new thumb, the vitality of which must be constantly watched.

B. In case of complete loss of the thumb and its metacarpal and more or less complete destruction of the thenar eminence, changes will be made to fit the specific needs of the case in question.

One can limit a dorsopalmar strip, larger at the base of the finger to be transposed, if that suffices to replace the loss of skin of the thenar eminence and create a commissure. In this case it will be necessary to make a small plasty to replace the skin lost at the donor site at the level of the commissure.

If the loss of skin is too extensive, it will be necessary to perform a skin plasty (with, for instance, a strip of abdomen) to create a commissure. The operatively treated hand is immobilized for fifteen days by plaster cast. It is important to put the hand and fingers, especially the new thumb, in the right position.

What should be kept of the fourth finger, in case of total loss of the first metacarpal? One can simply attach the phalanx to the multangulum by one or two metal threads, after having remodeled the multangulum to allow for opposition. The new thumb is then sufficiently short. One can also preserve the head of the fourth metacarpal and hold it in opposition to the multangulum, freed of its articular cartilage, or to the navicular in case of the loss of the multangulum, so as to obtain ankylosis. Movement will then take place in the mobile metacarpophalangeal joint. The new thumb will have the length one desires.

In case of complete destruction of the thenar eminence, it will be impossible to use the adductor and the opponens. This task will be assumed by the short flexor, but it will be necessary to cut the internal side of the first phalanx, open its pulley in its upper part, and force the superficial flexor through an aproneurotic ring to maintain the tendon in a horizontal position.

To resume, we repeat the condition necessary to the success of this operation, which we have not seen described anywhere:

Do the operation only on a hand which has become sound, supple and active, through an adequate period of convalescence.

Operate under tourniquet hemostasis, but do not prolong the ischemia unnecessarily.

Dissect a long tendinovasculoneural pedicle and be sure it does not become twisted.

Make the subaponeurotic tunnel sufficiently wide and in a plane corresponding to the direction the pedicle will take.

After the passage of the thumb and its fixation to either the multangulum, the navicular or the metacarpal, prevent retraction of the flexors by placing the new thumb in maximum abduction when suturing the extensor to the remaining tendons of the thumb extensor. *Place* tendinous and cutaneous sutures at different levels.

Immobilize the new thumb in forced extension and pronounced abduction, but do not put too much traction on the pedicle.

## SUMMARY

The author describes a method, which he considers original, of reconstruction of a partially or totally destroyed thumb and its metacarpal bone. He presents the rationale of his technic for "pollicization" of the fourth finger; there is no interference with a special functions of the index and middle finger. The new thumb has a good nerve and blood supply and is quite mobile, as the result of conservation of the tendinovasculoneural pedicle, which is isolated in the upper part of the palm. The finger, passed through the palmar subaponeurotic tunnel, results in a thumb in perfect opposition. Analysis of the causes of failure and the occurrence of complications shows that these should not take place if the aforedescribed rules are observed.

If there is insufficient skin, do not hesitate to do a skin graft, or, even better and safer, a skin plasty, using a strip of abdominal skin to make a new and large commissure.

These safety measures having been taken, the operation we have just described under the title of "pollicization of the ring finger" should carry little risk of failure either early or late and can, in our opinion, take a valuable place among the different methods of reconstruction of a thumb either partially or completely destroyed.

## RESUMEN

El autor describe un método de reconstrucción de un pulgar parcial ó totalmente destruído, que considera original. El presenta el fundamento de su técnica para convertir en oponente el cuarto dedo; no hay interferencia con las funciones especiales de los dedos índice y medio. El nuevo pulgar tiene un buen aporte vascular y nervioso y es bastante móvil como resultado de la conservación del pedículo tendinovasculoneural, que es aislado de la parte superior de la palma. El dedo es pasado a través de un túnel subaponeurótico palmar, resultando en un pulgar en oposición perfecta.

## RÉSUMÉ

L'auteur décrit une méthode—qu'il considère comme originale—de reconstitution d'un pouce, y compris son os métacarpien, totalement ou partiellement détruit. Technique personnelle de "pollicisation" de l'annulaire; les fonctions de l'index et du médius ne sont pas touchées. Le nouveau pouce ainsi obtenu est bien innervé et irrigué par la conservation du pédicule tendino-vasculo-neural, qui est isolé à la partie supérieure de la paume. L'annulaire, passé à travers le tunnel palmaire sus-aponévrotique devient un pouce qui peut faire une opposition parfaite.

## RIASSUNTO

Viene descritto un metodo originale per la ricostruzione parziale o totale del pollice e del suo metacarpo. Viene pollicizzato il quarto dito, senza pregiudizio della funzione dell'indice e del medio.

Il nuovo pollice è ben innervato e vascolarizzato ed è abbastanza mobile dacchè gli vien conservato il suo peduncolo vascolo-nervoso e tendineo. Il dito viene passato attraverso un tunnel palmaro subaponeurotico, resultato in un pollice aver opposizione perfetti amento.

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# Malignant Intra-Abdominal Nonchromaffin Paraganglioma

## Report of a Case with Survival of Eleven Years

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"MALIGNANT nonchromaffin paraganglioma" is the term we consider most descriptive of an ill-defined group of rare tumors that have been described in recent years under various names. Our interest was aroused through encountering an unusual case in this category. A review of the literature disclosed only 32 cases, previously reported, in which there were similar pathologic characteristics. The lesions in these cases were described under three different terms: malignant granular cell myoblastoma, alveolar soft-part sarcoma and malignant nonchromaffin paraganglioma. The term "malignant nonchromaffin paraganglioma" was first used in 1951 by Smetana and Scott,[1] who reported 14 cases.

### REPORT OF CASE

F. K., a white man, 68 years of age, was first admitted to General Rose Memorial Hospital on March 23, 1949, because of a painless mass in the left upper abdominal quadrant.

*History.*—The patient had first noted a symptomless mass in the epigastrium in July 1943. Operation on November 11 of the same year disclosed an encapsulated, rubbery, pink-gray tumor measuring 16 by 14 by 13 cm., attached to the anterior surface of the pyloric end of the stomach and to the transverse colon. The tumor was excised locally. The patient was well until four years later, when a mass appeared in the abdominal wall, in the upper portion of the operative scar. This was excised in 1947, after which an incisional hernia developed. We first saw the patient in March 1949, at which time he was complaining of "a growth in the upper portion of the left side of the abdomen."

*Physical Examination.*—Physical examination revealed a firm, movable, nontender tumor about the size of a small orange, in the anterior abdominal wall, above and to the left of the umbilicus. This mass was situated under the upper portion of a left paramedian scar. At the upper angle of the scar, above the mass, there was an incisional hernia about 6 cm. in diameter. There were no other remarkable physical abnormalities. Routine examination, including roentgen investigation of the chest and abdomen, gave results within normal limits.

On May 2, 1949, the old scar and the tumor (which was located within the rectus compartments), were excised, together with the adherent surrounding muscle and fascia, and the incisional hernia was repaired.

The patient returned on Nov. 21, 1950, with a mass deep to the scar, about the size of a hen's egg. This was resected on December 4; it extended to the peritoneum, which did not appear to be involved.

The patient again returned on June 11, 1951, with a 15 cm. intra-abdominal mass at about the level of the umbilicus and a small nodule under the old left paramedian scar. At operation the old scar and the small subcutaneous nodule were excised. The rectus compartment was free from tumor. Within the peritoneal cavity, a purplish, lobulated 17 cm. mass was adherent to the transverse colon, the lumen of which was partially narrowed by the mass. A small "daughter" tumor was observed above this on the mesocolon. These masses, which were well encapsulated, were excised as a palliative measure.

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[illegible] Medical Center and General Rose Memo- [illegible]
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Examinations in December 1952 and February 1953 revealed no abnormality. On March 10 and again on July 27, 1953, a symptomless movable mass was palpable just above the umbilicus. On September 9 the patient returned because of the increasing size of the mass and the associated pain. At operation on September 21 a very large mass, similar in appearance to the earlier tumor, was discovered in the proximal third of the transverse mesocolon, practically encircling the transverse colon and causing considerable obstruction. Several "daughter" tumors were seen on the posterior surface of the transverse mesocolon and in the mesentery of the distal 4 feet of ileum. There were no metastasss to the abdominal viscera or the mesenteric lymph nodes. The terminal 6 feet of ileum was resected, and the mesentery was excised widely. The ileocolic, right colic, and right branch of the middle colic vessels were ligated and divided at their origin, and the entire half of the colon was excised, together with wide excision of the mesentery. This amounted to *en bloc* excision of the entire tumor-bearing area (Fig. 1). End-to-side anastomosis between the ileum and the middle part of the transverse colon was then done in the usual manner. The patient had an uneventful postoperative course and was dismissed from the hospital on the tenth postoperative day.

He has been followed closely as an outpatient since his discharge from the hospital. Up to the time of writing (July 15, 1954) there has been no evidence of recurrence of the abdominal tumor. His condition has remained good except for mild secondary anemia. He has gained approximately 15 pounds (6.8 Kg.) in weight since his last operative procedure.

To recapitulate, the patient has undergone operations for intra-abdominal tumors and tumors of the abdominal wall in 1943, 1947, 1949, 1950, 1951 and 1953. His relatively good health after recovery from the latest operation, which had necessitated removal of a large portion of bowel, is remarkable.

*Gross Pathologic Picture.*—The specimen from the latest operation showed a large mass in the proximal third of the transverse mesocolon, which practically encircled the transverse colon and greatly narrowed its lumen. The tumor measured 13 by 10 by 6 cm. Its outer surface was smooth and reddish brown. The cut surface was solid, moderately firm to rubbery, mottled pinkish-gray to reddish-brown, and patchily hemorrhagic. Several smaller tumors, similar to that in the transverse mesocolon and measuring up to 4 by 3 by 3 cm., were seen in the mesentery of the terminal 4 feet of ileum and on the posterior surface of the transverse mesocolon.

*Histopathologic Picture.*—Comparisons between the first growth in 1943 and the recurrences showed that the histologic features of the tumor had not changed appreciably within the course of eleven years.

The cells formed cords, alveoli or diffuse masses surrounded by thin bands of collagenous tissue and capillaries. The cells were large and polyhedral, with a moderate amount of acidophilic cytoplasm containing fine granules and often showing fine to coarse vacuoles. The cell borders were fairly well defined. The nuclei were large, round, oval, elongated, spindle-shaped, curved or indented and were in central or eccentric positions. They possessed varying amounts of finely reticulated chromatin and distinct nuclear membranes. Dense pyknotic nuclei were often seen. A few giant hyperchromatic forms appeared occasionally. Mitoses were rare. Large areas of necrosis and hemorrhage were observed in many fields.

Reticulum stain showed coarse or slender fibers circling around groups of tumor cells. Other stains were noncontributory; fat was not demonstrated in the tumor cells.

## COMMENT

We found 32 similar cases in the literature. Seven of these were reported as cases of malignant granular cell myoblastomas.[2] Twelve cases were presented by Christopherson, Foote and Stewart[3] under the name "alveolar soft-part sarcoma." Fourteen more cases were recorded as instances of malignant nonchromaffin paragangliomas by Smetana and Scott.[1]

Shall we, therefore, call this tumor malignant granular cell myoblastoma, soft-part sarcoma, or malignant nonchromaffin paraganglioma? These tumors are not only similar to one another, but are all probably the same. (Ackerman,[4] Stout,[5] Willis[6]).

The term "malignant granular cell myoblastoma" suggests a relation between the tumor and the benign granular cell myoblastoma. At the same time, it implies that these tumors originate in primitive muscle. There is little evidence of this. There is no histologic resemblance between the ordinary benign granular cell myoblastoma and this type of tumor. Even the premise that the benign granular cell myoblastoma arises from primitive skeletal muscle is doubtful. In many cases the tumor has appeared in the breast, gums, skin, and subcutaneous tissues, where there is no skeletal-muscle tissue normally. Only recently, Harland[7] observed a typical granular cell myoblastoma in the region of the hypophysial stalk. Fust and Custer,[8] Ashburn and Rodger[9] and Bangle[10] have presented cases that prove the origin of at least some of these myoblastomas from neural tissue. Feyrter[11] has mentioned their neurogenic character and has suggested for them the term "granular neuromas." Willis[6] also pointed out that none of these benign myoblastomas has shown definite cross striations. He cited Gray and Gruenfeld, who observed no resemblance at any stage between the true myoblasts in the embryo and the component cells of these granular cell myoblastomas.

If the ordinary benign myoblastoma is to be associated with malignant forms,

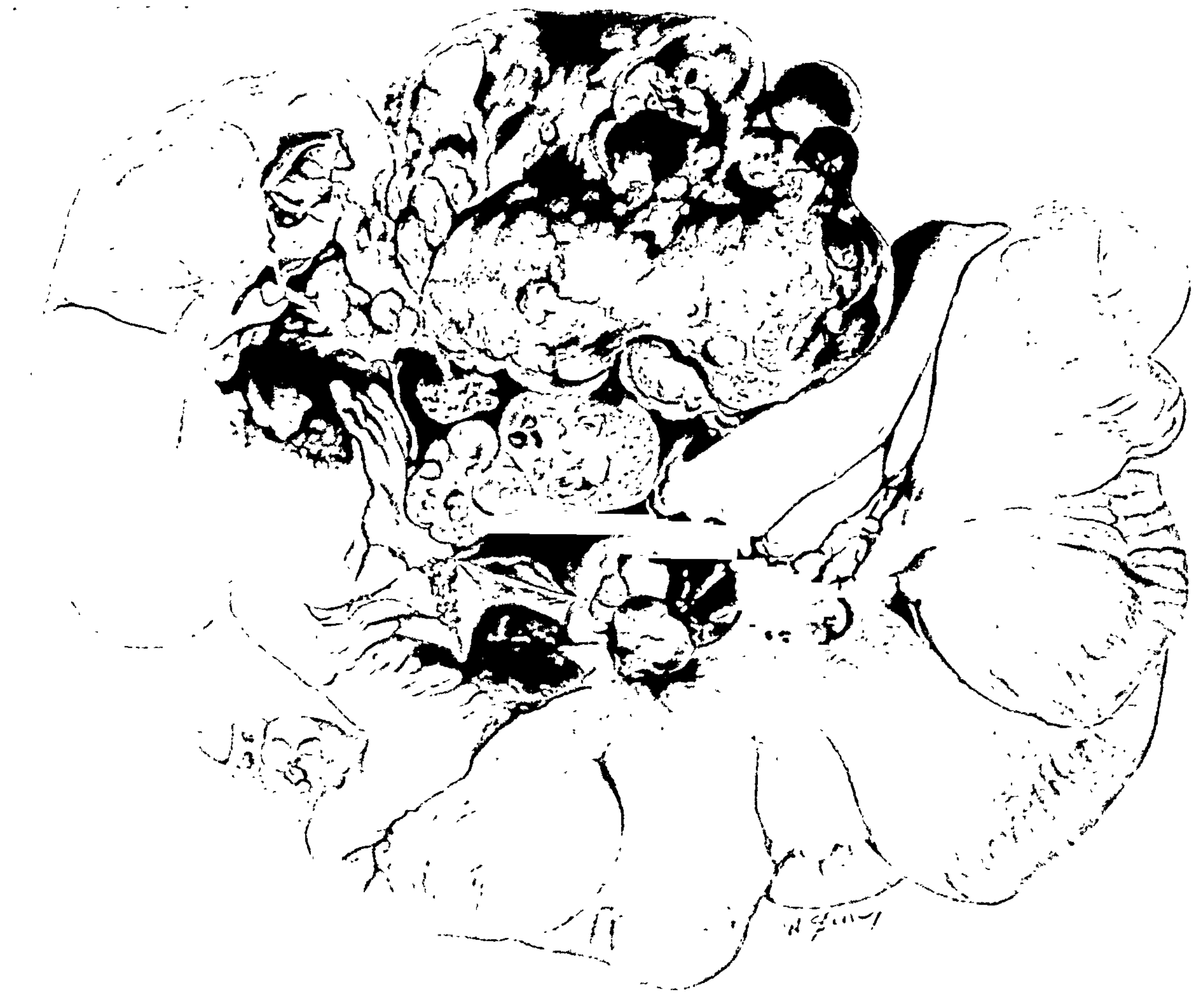

Fig. 1.—Tumor with portion of bowel, removed at the last operation.

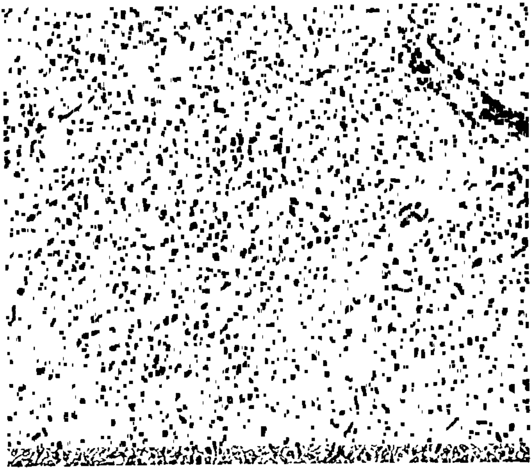

Fig. 2.—Appearance of tumor excised in 1943. × 175.

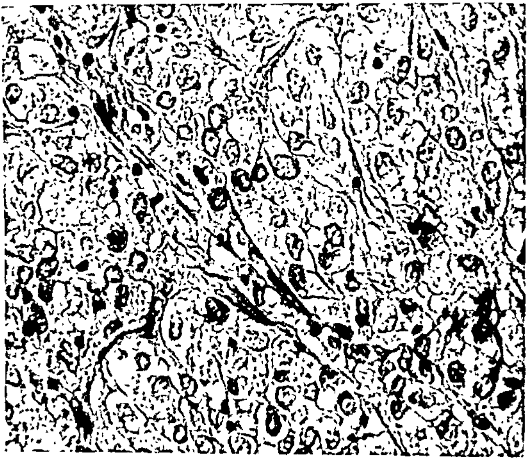

Fig. 3.—Appearance of tumor removed in 1953, resembling that in Figure 2 but showing a more distinct organoid pattern. × 130.

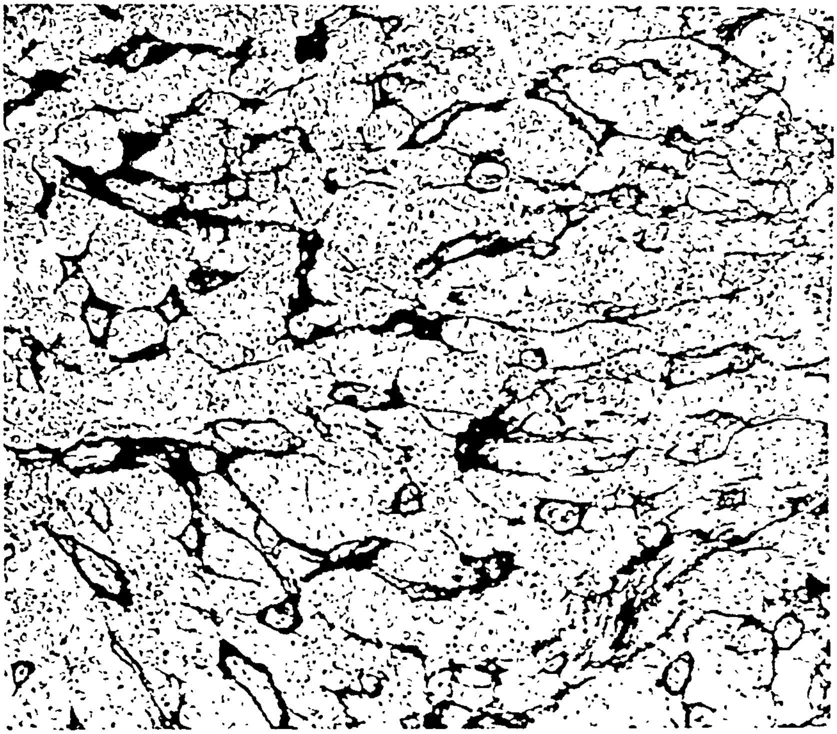

Fig. 4.—Higher magnification of Figure 3; large granular or vacuolated cells with round or oval nuclei. × 425.

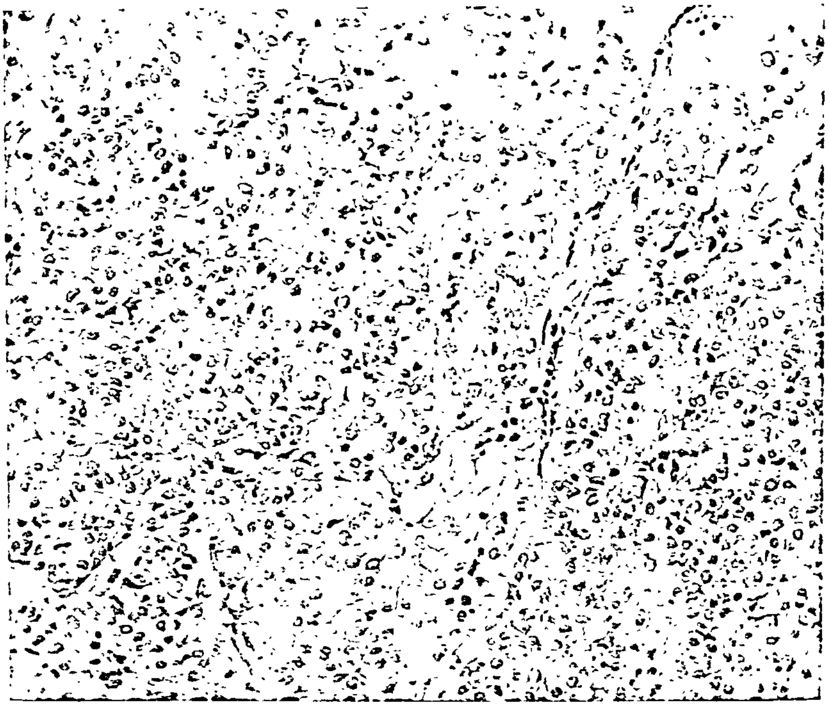

Fig. 5.—Photomicrograph with reticulum stain showing prominent vessels and discontinuous slender fibers between groups of cells. × 115.

the most convincing examples thus far occurred in the 3 cases recorded by Ross, Miller and Foote[12] in 1952. Photomicrographs of these tumors show the gradual transitions from the typical benign granular cell myoblastoma cells through areas with well-preserved granularity of the cells but with beginning pleomorphism of the nuclei to the extreme variants that consists of pleomorphic giant and spindle cells with nongranular cytoplasm and numerous mitotic figures. These malignant tumors, however, are entirely different from the one in our case and those in the 32 similar cases we have cited. Ross, Miller and Foote, in a review of the literature, found only 4 examples of this type of new growth. The number may even be less, because they included the tumor of the urinary bladder described by Ravich, Stout and Ravich, which had very little resemblance to the lesions in any of their 3 cases.

The designation "malignant granular cell myoblastoma," therefore, does not appear to be suitable in our case.

The term "alveolar soft-part sarcoma" was used by Christopherson, Foote and Stewart[3] because they were not certain of the histogenesis in their cases. They admitted that the histologic resemblance of these tumors to paragangliomas is impressive but will not subscribe to the term "malignant paraganglioma" because they do not know of any paraganglia occurring *in the extremities, where, in 10 of their* 12 cases, the tumors were observed. Smetana and Scott,[1] however, cited Lent C. Johnson, who observed structures of undetermined nature in the soft tissues surrounding the femoral vessels, which are similar to the glomus jugulare and the aortic and carotid bodies.

To us, the theory of origin formulated by Smetana and Scott[1] is most appealing. They have pointed out the similarities between this type of tumor and nonchromaffin paraganglia, in location and in cellular and structural characteristics. Most of these tumors have been reported to occur in regions where paraganglia have been demonstrated, e.g., the soft tissues of the thigh, neck, ear and retroperitoneum. For details concerning the location of paraganglia, the reader is referred to Smetana and Scott's article and its bibliography. The evidence in our case is in accord with this theory, since the tumor was attached originally to the pyloric end of the stomach and the transverse colon, a location where the presence of nonchromaffin paraganglia has been demonstrated in man and animals.[13]

The histologic composition of these tumors is similar to that of the carotid body and other nonchromaffin paraganglia. They exhibit the same organoid pattern, intimate relation of the component cells with capillaries and, often vacuolated granular acidophilic cytoplasm. The behavior of these tumors, as compared with that of neoplasms of nonchromaffin paraganglia, is even more striking. Growth in both types of tumor is slow, whether it is in its original site or metastatic site, and is not invasive, or only slightly so. Probably this explains the course of the disease even when metastases are present.

For the foregoing reasons we have chosen to call this tumor a malignant nonchromaffin paraganglioma, after Smetana and Scott's original suggestion.

*The clincial aspects of these tumors* are sufficiently similar to allow some conclusions with regard to treatment. As in many of the cases reported, the tumor in our case pursued a long, relatively benign course and recurred locally after every excision, yet failed to metastasize to distant sites in a period of eleven years.

When we first treated this patient we did not realize the very slight propensity of these tumors to develop distant metastases. Until this [illegible] bec [illegible] bvious, we had performed only limited palliative local excision of the nodules as they recurred.

The reappearance of the tumor at the original site and the implants in the abdominal wall are explained by inadequate excision and seeding of the tumor cells during operation. This might have been avoided by wide *en bloc* excision of the tumor and adjacent structures at the original operation. It remains to be seen whether the radical extirpation finally performed will accomplish better results. Since then a year has elapsed, and the patient is still free from symptoms or signs of reappearance of the tumor.

## SUMMARY AND CONCLUSIONS

A rare case of malignant intra-abdominal tumor is presented, the histologic features of which correspond with those reported previously under various names, and which we have concluded is best termed a malignant nonchromaffin paraganglioma.

The patient, after having undergone seven major operations within the past eleven years, the last of which necessitated removal of a large part of his bowel, is not only alive but still in relatively good health.

Because of the common clinical behavior of these tumors, i.e., slow, slightly invasive growth, great propensity to recur locally with no tendency, or a very slight tendency, to metastasize, the authors concluded that radical local excision is the best form of treatment, with close observation of the regional nodes and dissection of these nodes if metastasis is evident.

## RESUMEN

Se presenta un caso raro de tumor abdominal maligno cuyos hallazgos histológicos corresponden con los dados a conocer previamente con diversas denominaciones, estimándo los autores que la mejor denominación es la de "paraganglioma acromafín maligno."

El paciente después de siete operaciones de cirugía mayor en un período de once años, en la última de las cuales se extirpó una gran parte de intestino, no únicamente sobrevivió sino que se encuentra en estado satisfactorio de salud.

## RIASSUNTO

Viene descritto un raro caso di tumore endo-addominale maligno. La sua struttura istologica, corrispondente a quella di altri casi precedentemente riferiti sotto varie denominazioni, persuade gli autori ad adottare la seguente denominazione: "paraganglioma maligno a cellule non cromaffini." Il paziente, che aveva già subito negli ultimi undici anni sette gravi interventi (l'ultimo dei quali consistente nell'asportazione di gran parte dell'intestino), non solo è sopravvissuto ma si trova in abbastanza buone condizioni di salute.

## RÉSUMÉ

Um raro caso de tumor maligno intra-abdominal é apresentado, cujo quadro histológico corresponde à aquêle referido sob vários nomes e, que melhor poderia ser designado "malignant non-chromaffin paraganglioma."

O paciente, após ter sido submetido a sete intervenções durante os últimos onze anos, a última das quais exigiu a remoção de uma grande porção do intestino, está ainda vivo gozando de relativa bôa saúde.

## SUMARIO

L'auteur présente un cas rare de tumeur maligne intra-abdominale; ses caractéristiques histologiques correspondent à celles de cas similaires déjà rapportés, mais l'au-

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*Author's Note:* We are indebted to Dr. A. C. Broders and Dr. A. P. Stout for their helpful suggestions.

teur conclut que la meilleure terminologie est: "paragangliome malin non chromaffine."

Le malade a subi sept opérations importantes au cours des onze dernières années; la dernière a nécessité l'ablation d'une grande partie des intestins. Non seulement le malade est en vie, mais sa santé est relativement bonne.

### ZUSAMMENFASSUNG

Es wird über einen seltenen Fall einer bösartigen Bauchgeschwulst berichtet, deren histologische Merkmale mit die schon früher unter verschiedenen Namen veröffentlichten Tumoren vergleichbar sind; der Verfasser hält die Bezeichnung "malignes nicht chromaffines Paragangliom" für die beste.

Der Kranke, der in den letzten elf Jahren sieben grösseren Operationen unterzogen wurde, von denen die letzte die Resektion eines grossen Darmabschnittes einschloss, ist nicht nur am Leben, sondern erfreut sich noch immer eines verhältnismässig günstigen Gesundheitszustandes.

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# Treatment of Lithiasis of the Principal Biliary Channels

## New Instruments

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CALCULI of the principal biliary ducts are not always easily extracted; it is necessary to treat each patient adequately and individually.

Once the external exploration of the biliary ducts and the operative cholangiographic studies have led to a diagnosis of lithiasis of the hepatocholedochus canal, dislocation of the calculi toward the vesicle through the cystic canal must not be attempted. Not only does this fail to produce the desired result, but the calculi may glide to the hilum of the liver and be lost in the dilated intrahepatic canals. Maneuvers to impel them in the direction of the duodenum must also be avoided; since the pancreatic portion of the common duct is narrowed, its walls may be injured and the calculi may remain embedded there.

The squashing of a calculus between the fingers through the walls of the biliary duct generally causes serious damage to the tunica of that canal, which may become the site of future narrowing or cicatricial stenosis; and if the calculus is reduced to fragments, its extraction nearly always means a longer operation. Choice of the point of incision of the biliary tree (hepatocotomy or superduodenal choledochotomy) must always be subordinated to localization of the obstacle. In almost all cases, with careful maneuvering, this makes possible the extraction of movable and mobilizable calculi. Otherwise, it is advisable to incise near the border of the duodenum.

Instrumental exploration with probing nippers and catheters is excellent for locating the calculi in the duct or for appraising the permeability of the ampulla of Vater. Every such instrument must have at one end a perfectly shaped olive some millimeters in diameter (Fig. 1). Those which end in a ball point easily give ground to the sphincter of Oddi, but if this sphincter contracts the end will be caught, and in order to withdraw it a certain pull must be exercised. At the level of the papilla, in most cases, this causes damage that may vary from simple excoriation of the mucosa to extensive rupture of the sphincter. In an operative case of my own the globular end of the ball point catheter passed easily to the duodenal cavity through the sphincter, but its withdrawal was quite troublesome, owing to the resistance offered by contraction of the sphincter above the stem of the instrument. The postoperative period was without accident; some time later, however, the patient showed signs of obstruction of the common duct due to cicatricial stenosis at the level of the ampulla of Vater.

*Exploratory Catheter (Author's Model).*—More useful and less dangerous is my own catheter, malleable and provided at one end with a segment in olive-concave form; it is similar to a small curet with rounded borders (Fig. 2) and is appropriate for probing the biliary canals to determine the degree of permeability of the sphincter of Oddi and to dislodge small calculi in the region.

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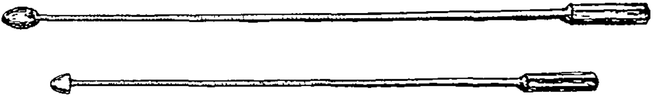

Fig. 1.—*Above,* instrument with olive tip. *Below,* instrument with ball tip.

Once the calculus is located, since it is impossible to mobilize it with the help of light touching maneuvers, its extraction is generally accomplished by means of curets or nippers for the extraction of calculi of various shapes.

*Curets:* The curets in general use are based on the model employed at the Mayo Clinic, with graduated spoons 3 to 8 mm. in diameter, the terminal extremity of which, in addition to facilitating extraction of the calculi, permits probing and dilation of the sphincter of Oddi. Owing to their length (280 mm.) they traumatize frequently, enlarging even the surgical opening of the biliary duct at the moment of introduction into the lumen or during the maneuvers performed while the calculi are being taken out.

*Dismountable Curets for Extracting Calculi (Author's Models):* The dismountable curets I have devised and have been using in the clinic since 1946 consists of two parts: the curet and a handle (Figs. 4 and 5). The curet, with a flexible stem ending in a screw, is 13 cm. long. Some are made with spoons and are similar to the Mayo Clinic model; others, of different dimensions and shapes, are used in accordance with the degree of dilation of the biliary canal and the volume of the calculus to be extracted.

The *metallic handle,* is two lengths (5 and 11 cm., has, at one end, a nut by means of which the screws are attached.

Owing to its flexibility, the stem can be curved according to the anatomic disposition of the biliary duct. If, after being introduced into the lumen, the curet does not reach the calculus, its length can be increased 5 to 11 cm., since its original length is sufficient to enable one to attach a metallic handle of the desired length.

With the use of this instrument, trauma at the level of the surgical opening of the biliary duct is avoided, especially when the patient is obese and brevilinear. On the other hand, the shape given to the long groove in its body permits simultaneous removal of various small calculi.

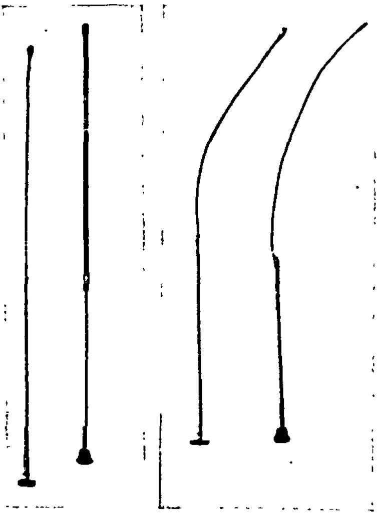

Fig. 2.—Author's exploratory catheters. *Left,* [illegible]; *rig*[illegible] view.

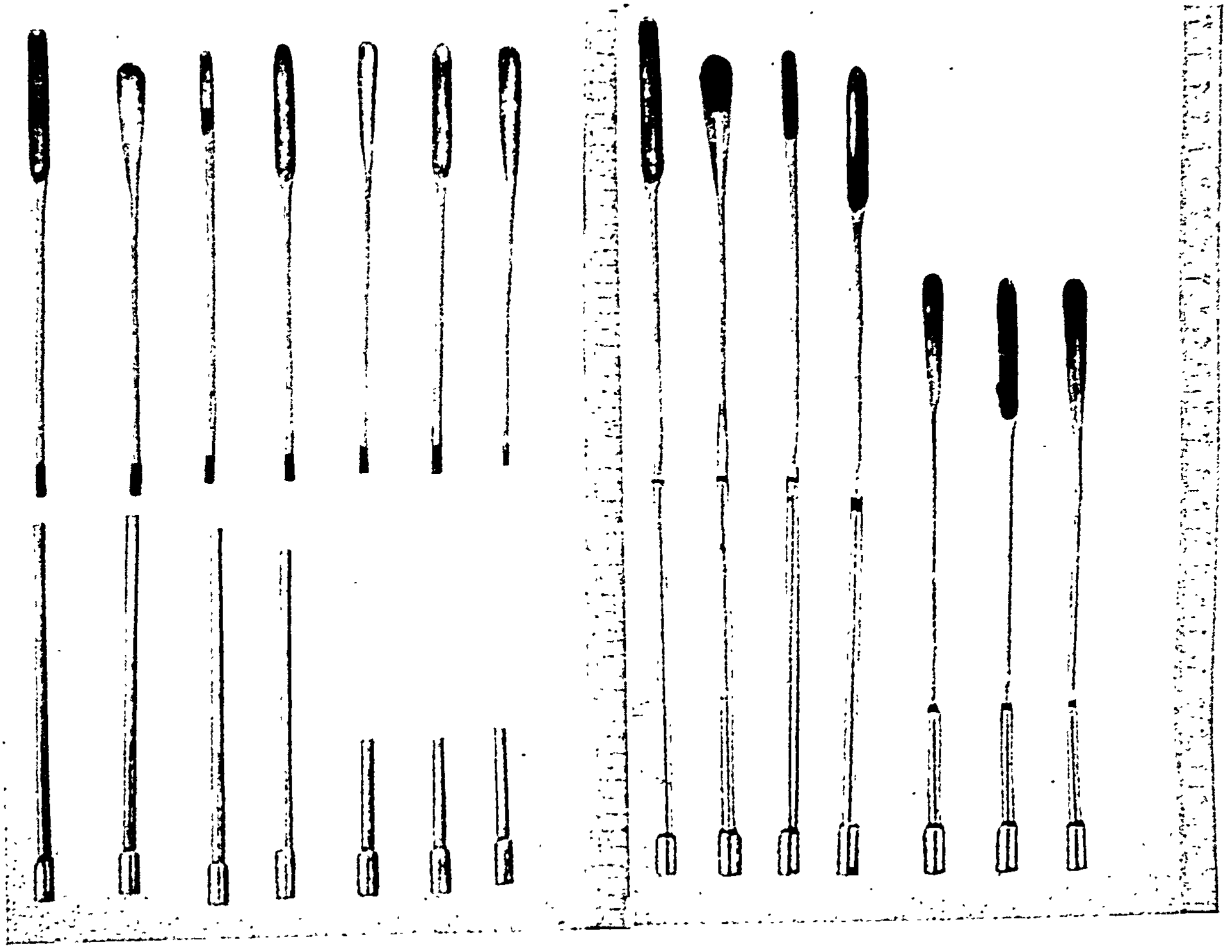

Fig. 3.—*Left,* curets disassembled. *Right,* curets assembled.

If the calculus is impacted in the lumen, the operative difficulties increase according to its location. If it is in the pancreatic region of the common or even the hepatic duct, the carefully maneuvered curet glides beside it, causing it to drop into the concavity; but this is not always possible, and if the walls of the duct are edamatous their tunicae may be damaged, the later consequences of which are only too well known.

*Nippers:* The nippers, which in most cases permit easy removal of movable or mobilizable calculi, do not perform this service if the calculi are imbedded. What happens in most cases is that the legs of the nippers, introduced into the narrow and only slightly distensible lumen of the duct (pancreatic region, preampullary segment of the common duct or even the ampulla of Vater), when they open near a calculus inset and perfectly adjusted to the edematized walls of the duct and are not able to grasp it, distend and traumatize the tunica and, if they do not break the calculus, corrode and dig up the ductal walls, thus making it more and more difficult to detach the stone. In cases of blind extraction, in which the surgeon is guided by touch, the forced passage of the legs of nippers of appreciable thickness between the calculus and the inflamed walls of the biliary canal is usually accomplished at the cost of more or less serious damage to the tunica and may even create a false channel to the inside of the duodenum, which leads to undesirable consequences (hemorrhage, duodenal fistula, peritonitis, cicatricial retraction, etc.).

As can be noted from the foregoing comments, the curets, even when used with maximum care, are difficult to pass between the calculus and the edematized canal without causing damage to the walls.

*Author's Probing Nippers for the Extraction of Calculi:* In order to avoid those inconveniences and to facilitate the extraction of inset calculi, I have devised flexible probing nippers which bear my name (probing nippers Zamitti Mammana). This instrument, made in various lengths and with legs varying in size, can also be used in operations for the extraction of renal, urethral and other calculi.

The probing nippers are provided at their extremities with two handles of flexible steel wire, in shape like the legs of the nippers, used to seize the calculus. Maneuvered by means of a button located at the other end, they can be moved from either front or back. The mechanism controlled by the button, which moves the legs of the nippers, is covered by a rubber or plastic probe (Fig. 6).

The apparatus is shown (*above*) with the handles short and very close to each other.

When the button is pressed, a special mechanism projects the two nippers handles forward, making them longer (*below, left*). Owing to their flexibility and the slight outward curvature of their ends, when these are once in contact with the calculus they separate, glide and pass its walls, gripping the stone between the nipper legs at their midportion, which is large and window shaped (*below, right*). On release of the button the handles return automatically to their original position and the legs, becoming shorter, approach each other, keeping the calculus imprisoned under pressure.

*Advantages.*—Among the numberless advantages offered by this type of nipper as compared with others used for the extraction of calculi, the following are the most important:

The cylindric form and the flexibility of the stem permit its easy introduction into the principal biliary ducts (hepatic or

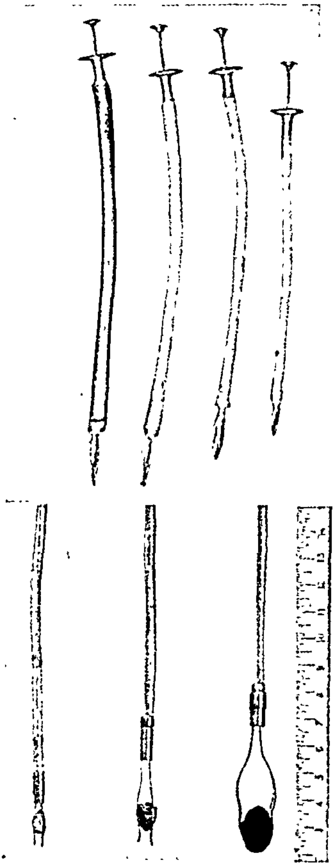

Fig. 4.—[illegible]

common) at the same time, following the curves of the ducts and facilitating internal exploration.

The mechanism that moves the legs of the nipper handles, controlled by the external button, working inside the probe, is removed during extraction of the calculus, thus obviating the danger of trauma within the duct or at the level of the surgical opening of the biliary canal.

Made in different sizes, it facilitates the extraction because the instrument to be used is chosen in accordance with the dimensions of the calculus as appraised by digital palpation or operative cholangiographic studies.

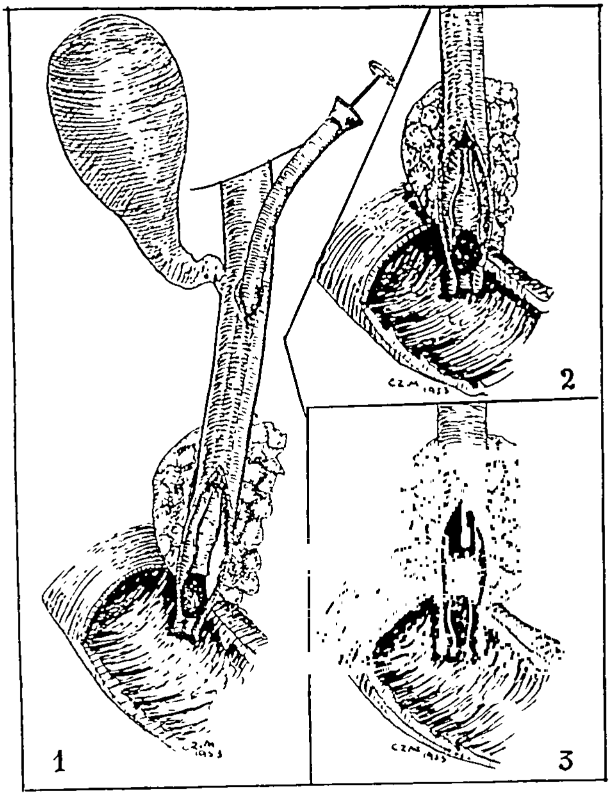

Fig. 5.—Nippers in use: *1*, very short legs of nipper handles very close together; *2*, nipper handles, projected forward, become longer, and their ends, separated from each other, begin to glide around the walls of the calculus. When the button is released *(3)*, the nipper handles return to their original position and the calculus remains enclosed.

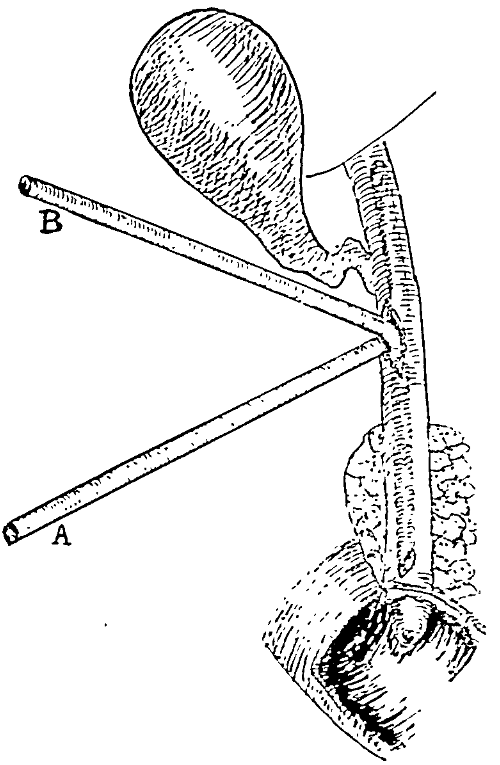

Fig. 6.—External drainage of the principal biliary canals. Probe *A* penetrates into the hepatic canal to the extent of 3 cm. Probe *B* has its extremity located near the ampulla of Vater. Note that the caliber of the probes is smaller than that of the biliary duct.

On pressure of the button the legs of the nipper handles, made of fine flexible steel, impelled toward the front, separate only when they meet resistance from the calculus. At this point they glide from one side to the other on the external surface, in the interstice that separates it from the walls of the biliary canal. Any friction or pressure exerted by the nipper handles is made directly upon the calculus, which protects the tunics of the duct from avoidable damages.

If the surface of the calculus is irregular and does not permit seizure, the instrument is drawn back some millimeters, by rotation 45 to 90 degrees to the right or to the left; then a new attempt is made.

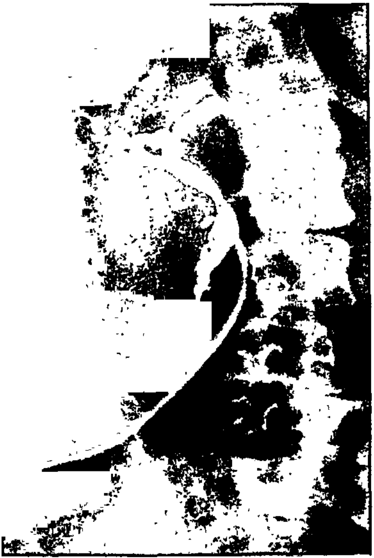

Fig. 7.—Postoperative cholangiogram of patient G. M., taken after injection of a contrast medium through the probe in the common duct. Injected under a certain amount of pressure, the contrast medium causes contraction of the sphincter of Oddi.

*External Drainage of the Principal Biliary Canals.*—Once the calculi are extracted, I usually complete the operation with external drainage of the biliary canals by means of two independent probes, of smaller caliber than the lumen of the duct: one (Probe *A*) is put into the hepatic canal, where it penetrates about 3 cm., while the other (Probe *B*) is introduced into the lumen of the common duct, with its extremity located near the ampulla of Vater (Fig. 8). In "indicated cases" the sphincter of Oddi is cleared until penetration to the inside of the duodenum has been accomplished. The probes, crossing each other at the level of the surgical opening of the biliary canal, are tied separately to the walls of the duct by means of two stitches with No. 00 chromic catgut; then the closing of the canal is completed with a choledochorrhaphy. The drains are fixed separately to the skin with stitches of surgical silk.

A large part of the secreted bile passing through Probe *A* is collected in a sterilized bottle, and the remainder, a small quantity, flows off to the duodenum between the probes and the walls of the biliary duct. The collected bile, after being filtered and mixed with 100 cc. of sulfuric ether, is heavily agitated for ten minutes. Then it is decanted, the excess of ether is removed, and the bottle is put in a cask of warm water to allow volatilization of the remaining ether. The lukewarm bile is

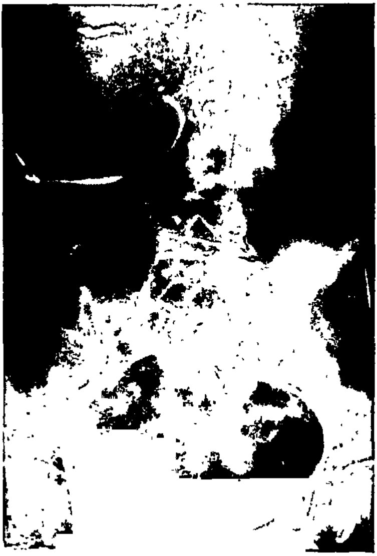

Fig. 8.—Roentgenogram taken moments ter, showing that the contrast has d the sphinc

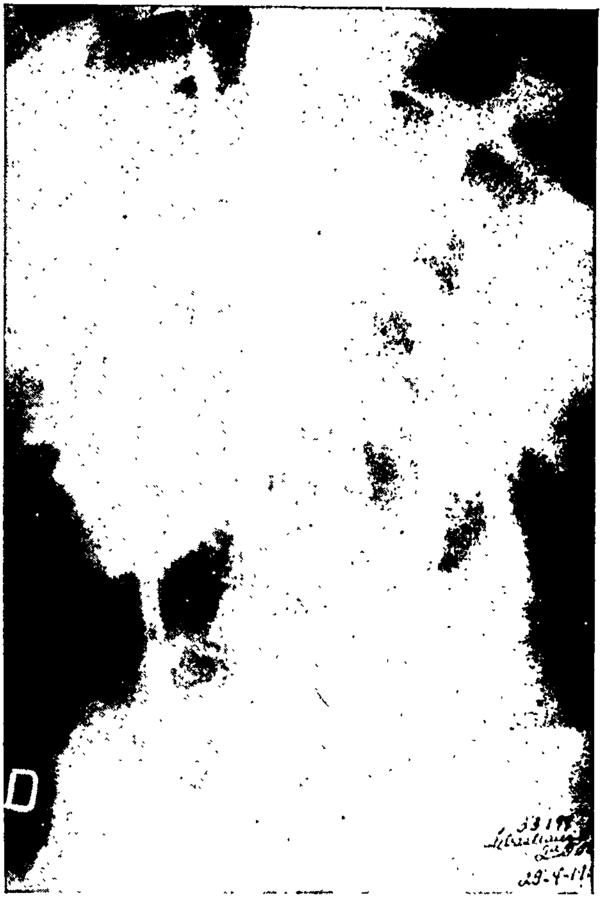

Fig. 9.—Simple roentgenogram showing the disposition of the two probes in the interior of the biliary canal.

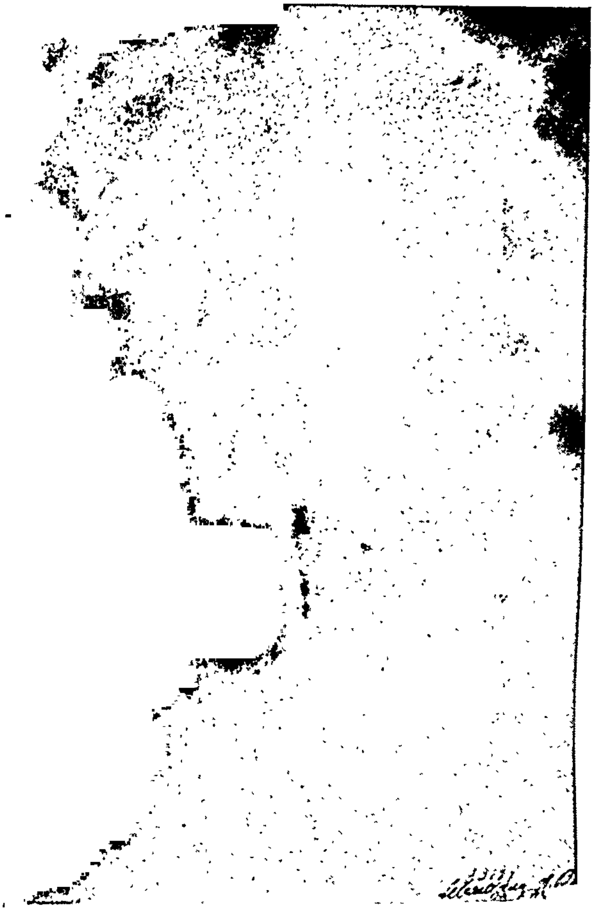

Fig. 10.—Postoperative cholangiogram of patient S. B., taken at the time the contrast medium was injected.

slowly injected into the common duct through Probe *B*. If the sphincter of Oddi is free, passage to the duodenum is easy.

For that purpose I use a 100 cc. glass syringe, which, with the intermediary part adjusted to the end of Probe *B*, is put in a vertical position with the embolus upward and at a level of about 20 cm. higher than the body of the patient, to permit the bile to flow off by gravity, aided in part by the weight of the syringe's embolus. This operation is repeated every twelve hours, advantage being taken of all the bile secreted during that period. In cases of infection of the biliary tree I inject through the probe; a little later, 2 ampules of 5 cc. red prontozil.

Except in cases of obstruction of the terminal portion of the common duct by residual calculi, the patient, during injection through the probe, may complain of colic and a sensation of discomfort due to distention of the biliary canals caused by the accumulation of bile under pressure, in consequence of a spasm of the sphincter of Oddi. In such cases the syringe is put at a lower level than that of the patient, and, when part of the injected contents is aspirated, pressure in the biliary tree begins to decrease and the troubles caused by it disappear. Some minutes later the syringe is slowly lifted, so that its contents, slowly dropping off, in most cases overcome the resistance of the sphincter.

By means of this process I have been able to feed my patients on the first days

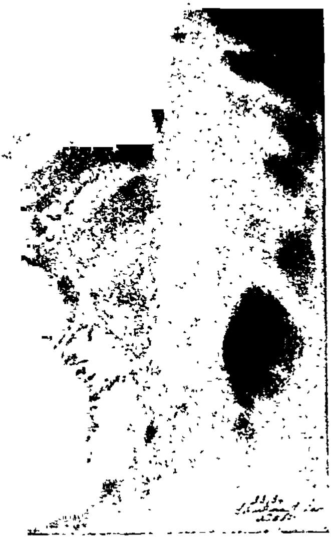

Fig. 11.—Postoperative cholangiogram of same patient, showing the passage of the contrast medium to the duodenum.

after the operation, and it was not necessary to give them bile per os or succedanea (Figs. 9, 10, 11, 12, 13, 14, and 15).

This drainage, in addition to supplying valuable information as to the progress of the case, permits postoperative cholangiographic investigation, which is of great value and convenience in removing the probes. With the external ends of the probes clamped together, the passage of bile to the duodenum can be controlled, because, as has been explained, it takes place between Probes *A* and *B* and the walls of the principal biliary canal.

Once the chromic catgut is absorbed, the probes may be removed independently of each other and at different times, without traumatizing the orifice of the biliary duct—a thing that is impossible to do with the Kehr probe, which, besides presenting this inconvenience, may break at the juncture of the legs of the T.

## SUMMARY

The author's rationale, technic and instruments for surgical treatment of lithiasis of the principal biliary canals are described, as is his technic of drainage. This type of drainage, in addition to supplying valuable information as to the patient's course, permits the employment of postoperative cholangiographic procedures.

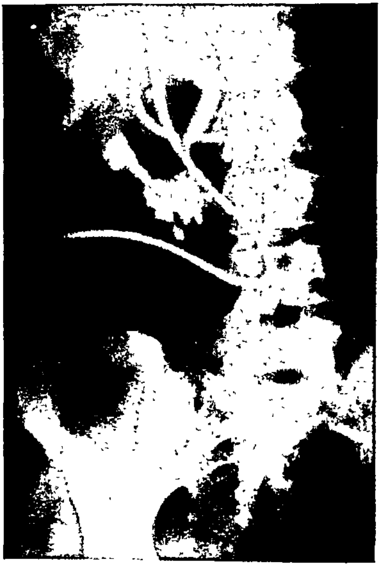

Fig. 12.—Postoperative cholangiogram of patient M. V. The contrast medium, injected through Probe *A* (Fig. 6) in the hepatic duct, passes freely into the common duct around Probe *B* and, after passing the sphincter of Oddi, is eliminated in the duodenum.

## RÉSUMÉ

L'auteur décrit sa technique et son instrumentation pour le traitement de la lithiase des voies biliaires principales, ainsi que sa technique de drainage. Ces précieux renseignements au sujet de l'évolution du malade permettent l'utilisation de la cholangiographie post-opératoire.

## ZUSAMMENFASSUNG

Der Verfasser gibt die Überlegungen an, die seiner Methode der chirurgischen Behandlung von Steinerkrankung der grossen Gallenwege zugrunde liegen, und beschreibt die von ihm angewandte Technik, seine Instrumente und Form der Drainage. Dieses Verfahren gestattet die Anwendung postoperativer Cholangiographie und ermöglicht wichtige Informationen über den Krankheitsverlauf.

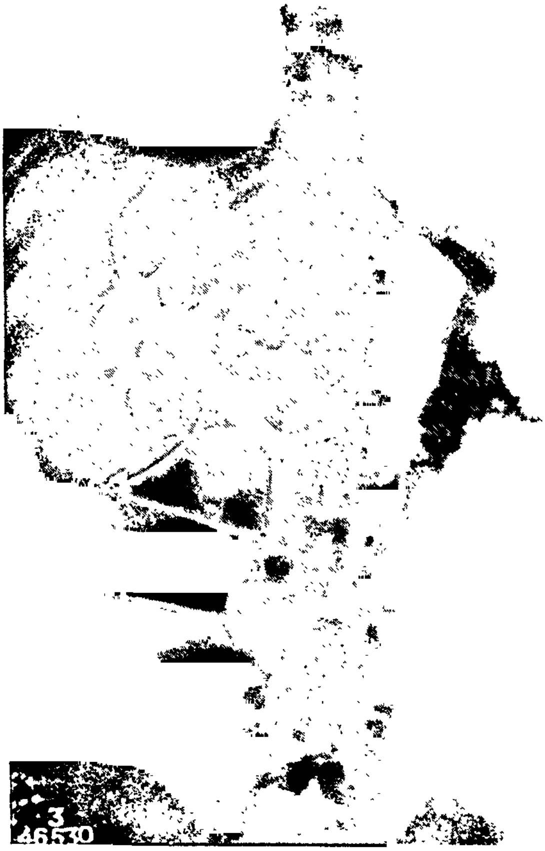

Fig. 13.—Postoperative cholangiogram of patient C. V. Probe *A*, located in the hepatic duct, has already been removed. The contrast medium, injected by Probe *B* (located at the cavity of the common duct), has filled the bilitary tree, at the same time passing on to the duodenum.

## RESUMEN

Se describen los razonamientos técnicos e instumentales del autor para el tratamiento quirúrgico de la litiasis de la vía biliar principal, así como para su técnica de drenaje. Relacionando este tipo de información con la evolución del paciente, que permite el uso de procedimientos colangiográficos.

## RIASSUNTO

Vengono descritti il metodo, la tecnica e lo strumentario per la cura chirurgica della litiasi del coledoco e il drenaggio delle vie biliari. Quest'ultimo consente l'impiego della colangiografia postoperatoria.

## SUMARIO

O autor descreve sua orientação, técnica e instrumentos para o tratamento cirúrgico da litiase das vias biliares, bem como a técnica de drenagem que emprega. As informações referentes a evolução do paciente permitem o uso da colangiografia pós-operatória.

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# Surgical Treatment of Polycystic Kidney

## Report of First Case Complicated by Cholesteatoma*

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BECAUSE one learns by iteration and reiteration, it is important to repeat as often as possible that destructive polycystic disease of the kidney must be diagnosed early in its course and that many patients treated for Bright's disease associated with hypertension and uremia are actually suffering from polycystic disease. The usual bilateral nature of the disease challenges the surgeon's ingenuity, and no other operation on the kidney requires greater deliberation and keener judgment than does surgical treatment of this condition.

With modern diagnostic methods—excretory and retrograde pyelographic and arteriographic studies and perirenal insufflation—the condition can be recognized in most cases. The diagnosis and treatment of concomitant ureteral stricture preserve kidney tissue and prolong life. When one realizes that polycystic kidney occurs in approximately 1 in 378 to 600 necropsies (Carlson), 1 in 3,253 to 3,500 hospital admissions (Carlson), 1 in 500 to 750 births (Higgins) and 1 in 4,000 clinical examinations (Higgins), it becomes obvious that surgeons must be alert to this diagnostic possibility.

Some relevant characteristics of polycystic disease, its complications and the indications for conservative operation for relief of intrarenal tension and intractable pain, as well as those for radical intervention (nephrectomy), will be presented, and a case of polycystic kidney disease and cholesteatoma treated by nephrectomy will be reported.

Although polycystic kidney disease is usually bilateral, some maintain that it may be unilateral. In Chevassu's opinion it is always bilateral, even though it may be manifest in only one kidney. Lack of clinical evidence is not an infallible indication of unilaterality, because early and latent cysts in the opposite kidney may be overlooked. Clinicians have observed that cyst formation may be much slower in one of the kidneys than in the other. Ravitch and Sanford clearly differentiated unilateral multicystic from polycystic renal disease. In the former there is no semblance of renal architecture in the affected kidney, cortical substance, papillae or pelvis. Occasionally a fibrous cordlike ureter has been observed. In polycystic disease of the kidney the fundamental renal architecture is normal between the cysts, being compressed by cystic formation. Dérot, Marcel and Saloün described 3 cases of unilateral involvement in children; in 1 of them the opposite kidney had been examined by exploratory lumbotomy and in the others by roentgen rays. According to a later report by Marcel, the total number of cases of unilateral polycystic disease of the kidney from 1885 to 1954 is 135. Carlson is the only one to have reported the occurrence of polycystic disease in a congenital solitary kidney.

Associated congenital anomalies are fairly common: [illegible], st [illegible] ierary-

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fingers or toes, club feet, intracranial aneurysms and others; in 40 per cent of all cases, cysts of the liver, uterus, spleen and other organs are also present. Congenital malformation of the polycystic kidney itself is relatively rare.

Other conditions may coexist with the polycystic disease—ptosis, torsion, calculi and hydronephrosis among them. When torsion is present, it is well to carry out nephropexy (Llanos, Mathé, Papin). I have reported the case of a patient, Mrs. K. M., in which intractable pain was relieved by nephropexy and sympathectomy and by decapping, puncture and cauterization of numerous cysts in the kidney and liver. Kidney stones are removed in the usual manner. It is better to remove stones situated low in the ureter by ureterolithotomy than to risk cystoscopic manipulation. Plastic operations for hydronephrosis are performed as in cases without polycystic disease.

In addition to impairment of renal function, two conditions that arise from the disease are pain due to enlargement of the cysts and back pressure due to ureteral stricture. In 1939 Hunner published his interesting observation on bilateral ureteral stricture, usually in the lower portion of the ureter, associated with polycystic kidney. He pointed out that this condition is often mistaken for Bright's disease. With either condition the patients suffer uremic convulsions, hypertension, hematuria, anemia, fever and back pain. These symptoms were greatly ameliorated or entirely relieved, in Hunner's experience, by progressive dilation of the ureter. Hunner demonstrated that relief of stasis retards destruction of renal tissue already damaged by intrarenal pressure due to encroachment by the cysts. He emphasized the importance of employing the bulb catheter in diagnosing these strictures, noting the characteristic hang during withdrawal of the bulb bougie. He also pointed out that in some instances obstruction of the upper part of the ureter is due to lateral pressure of a large cyst. In the cases under my observation, a meticulous search has been made for ureteral stricture, and it has usually been found. Dilation is then carried out at intervals of four months to one year.

Ureteral drainage should be included in the over-all treatment of this progressively destructive disease. In 2 patients, from each of whom a polycystic kidney was removed (one because of a complicating tumor and the other because of sclerosing calculous pyelonephritis), the stricture of the remaining ureter has been dilated periodically (Fig. 4, *A* and *B*). The well-being and freedom from pain of these patients is remarkable.

## TREATMENT

Medical treatment is confined to dealing with the concomitant conditions — pain, complications of stricture — and perhaps hormonal therapy. Dérot and his associates advocated administration of testosterone over a long period, which, they claimed, retards azotemia.

Because of the customary bilaterality of this disease, conservative surgical treatment is preferable unless the surrounding circumstances make more radical treatment necessary. Progressive enlargement of the cysts increases intrarenal pressure and causes destruction of renal parenchyma. In order to arrest this pathologic process, Rovsing devised his multiple puncture operation. It is generally agreed that the indications for this operation are (1) diminution of renal function, recognized in gradual rise in blood chemical values and decrease in renal excretion of urine; (2) persistent pain; (3) intracystic hemorrhage; (4) progressive elevation of blood pressure; (5) limited renal involvement, and (6) poor results of medical treatment

of over 60 mg. per hundred milliliters of blood. Indications for nephrectomy are cancer, caseocavernous tuberculosis, pyonephrosis, irreversible extensive hydronephrosis, intractable diffuse pyelonephritis, voluminous and numerous calculi and exsanguinating hemorrhage. After unilateral conservative or radical operation the remaining kidney may decrease in size.

Before the advent of the antibiotics the mortality rate following nephrectomy for pyonephrosis complicating polycystic kidney was high. In 1921 Chevassu reported 7 deaths among 24 patients who underwent nephrectomy for pyonephrosis, cancer, lithiasis and other complicating lesions. If the function of the opposite kidney is adequate and proper drainage and antibiotic therapy are carried out, the mortality rate is no greater than that for nephrectomy for pyonephrosis without polycystic disease. In 1934 Walters and Braasch reported 85 operations on polycystic kidneys; of the 31 patients who underwent nephrectomy, only 1 died.

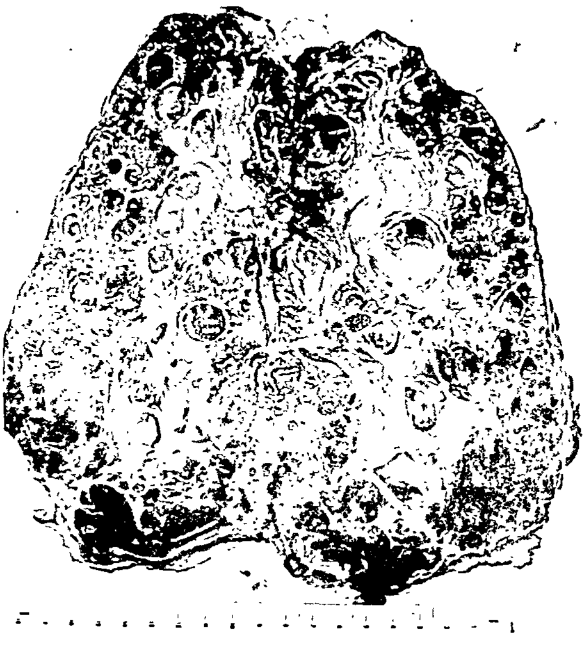

Fig. 2.—Sagittal section showing cysts of varying size and complicating cholesteatoma of left kidney.

Nauman and Sabatini reported a case of cholesteatoma of the kidney. Although this tumor commonly occurs in the brain and occasionally in other parts of the body (intestinal tract, genitalia, eyes and elsewhere), their review of the literature revealed only 8 authentic cases of cholesteatoma of the urinary tract, none accompanied by polycystic kidney disease.

## REPORT OF A CASE

Mr. K. W., aged 44, entered St. Mary's Hospital on March 10, 1952, suffering from painful swelling in the upper left abdominal and lumbar regions, frequency of urination and hematuria. He had had attacks of hematuria in 1942 following trauma; in 1946 after a long drive in an automobile; on Feb. 28, 1952, after trauma to the left flank. Numerous physicians had diagnosed polycystic disease of the kidney, and he was told that only medical treatment could be carried out. The patient's maternal grandmother, two maternal uncles, two maternal aunts and his mother all died between the ages of 42 and 55 years, from polycystic disease of the kidney.

On examination, no evidence of other congenital defects was discovered. The results of laboratory and roentgen studies were as follows: Urinalysis revealed sanguineous urine in all three glasses, indicating that the blood was of renal origin; the specific gravity was 10.25; the reaction for albumin was 3 plus, and there were numerous erythrocytes. Blood chemical studies disclosed the value for nonprotein nitrogen to be 45 mg., and that for creatinine 2.1 mg., per hundred milliliters. There were 4,980,000 erythrocytes per cubic millimeter, with 14 Gm. of hemoglobin, and 13,500 leukocytes per cubic millimeter. By the end of the second hour, 59 per cent of the injected phenolsulfonphthalein had been excreted. Retrograde pyelographic studies revealed the dragon-shaped deformity of both renal pelves characteristic of polycystic kidney. The lower minor calyx of the left kidney was elongated, indicating a complicating tumor (Fig. 1). Indigo carmine appeared in good concentration in the urine from the right kidney in four minutes and in poor concentration from the left kidney in seven minutes. Excretory urographic studies confirmed the presence of polycystic disease of the kidney, with distention of the left renal pelvis.

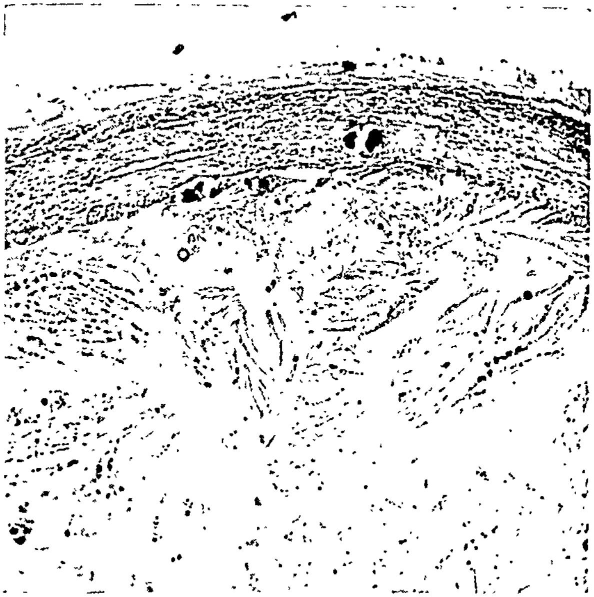

Fig. 3.—Cholesteatoma. Section showing amorphous granular and calcific material, interspersed with fusiform spaces consistent with cholesterol and fatty acid crystals. Note surrounding fibrous wall, containing chronic inflammatory cells and brown pigment-laden macrophages. × 60.

age, carried out by periodic dilation of the ureter, relieves stasis and retards destruction of renal tissue already damaged by pressure due to the progressive development of the cysts.

Destructive lesions limited to either pole of the polycystic kidney may be relieved by partial nephrectomy, and those involving half of a bifid kidney may be treated by heminephrectomy, in the same manner as in patients without polycystic disease.

The first case of cholesteatoma complicating polycystic disease of the kidney is reported. This condition was treated by nephrectomy and thereafter by repeated dilation of the remaining ureter. The patient was well two years and five months after the operation.

## RESUMEN

Ya que la enfermedad poliquística del riñón se confunde tan amenudo con la enfermedad de Bright, el urólogo debe estar alerta. El estudio pielográfico excretor y retrógrado, la arteriografía y la insuflación perirrenal ayudan al diagnóstico de riñón poliquístico en la mayoría de los casos. El diagnóstico temprano ofrece la oportunidad de realizar tratamiento quirúrgico conservador. En los casos seleccionados apropiadamente la punción de los quistes, bisección renal, decapsulación, nefropexia y simpatectomía retardan el progreso de esta enfermedad, alivian el dolor y prolongan la vida. La técnica correcta y la terapia antibiótica previenen la infección postoperatoria y la fístula renal. El cirujano urológico no debe dudar en realizar operaciones conservadoras antes de que el riñón sea irreparablemente lesionado. La nefrectomía debe hacerse para tumor maligno coexistente, pionefrosis, tuberculosis, hidronefrosis irreversible, pielonefritis difusa intratable ó enfermedad calculosa extensa, teniendo en cuenta que la función del riñón contrario sea adecuada conforme a la concentración de nitrógeno no proteico (normalmente por debajo de 60 mgr.). Después de la operación unilateral el riñón poliquístico contrario puede disminuír de tamaño.

El exámen minucioso para la estenosis ureteral concomitante que frecuentemente se presenta es altamente importante. El drenaje ureteral llevado a cabo por la dilatación períodica del uretero alivia la estásis y retarda la destrucción del tejido renal previamente lesionado por la presión debida al desarrollo progresivo de los quístes.

Las lesiones destructivas limitadas a cada polo del riñón poliquístico pueden aliviarse por nefrectomía parcial y aquellas de la mitad de un rión bífido pueden tratarse por heminefrectomía, en la misma forma que en pacientes sin enfermedad poliquística.

El primer caso de colesteatoma complicando enfermedad poliquística del riñón se comunica, habiéndo sido tratado, por nefrectomía y posteriormente por dilata-

ciones repetidas del uretero restante. El paciente estuvo bien dos años y cinco meses después de la operación.

## RIASSUNTO

Poichè la malattia policistica del rene è troppo spesso confusa col morbo di Bright, conviene che gli urologici siano guardinghi. L'urografia, la pielografia ascendente, l'arteriografia, il pneumorene sono altrettanti mezzi che possono autare nella diagnosi. Una diagnosi precoce offre spesso la possibilità di una cura chirurgica conservativa. In casi opportunamente scelti è possibile ritardare il corso della malattia, alleviare il dolore e prolungare la vita mediante vari mezzi come la scapsulazione e la puntura delle cisti, la resezione del rene, la decapsulazione, la nefropessia, la simpatectomia. Si possono evitare le infezioni post-operatorie e la formazione di fistole con una tecnica corretta e con l'uso di antibiotici. Non si deve aver dubbi sulla necessità di tentare gli interventi conservatori prima di sacrificare il rene. La nefrectomia deve essere riservata ai casi in cui coesiste un tumore maligno, o pionefrosi, tubercolosi, idronefrosi grave, pielonefrite diffusa grave, calcolosi di alto grado, ecc., patto che il rene controlaterale sia ben funzionante e l'azotemia normale. Dopo l'intervento da un lato, il rene adelfo può anche diminuire di volume. E' assai importante fare un esame accurato dell'uretere per ricercare eventuali stenosi concomitanti, che in genere sono presenti. Il drenaggio dell'uretere, mediante dilatazioni periodiche, combatte la stasi e rallenta la distruzione del parenchima renale ad opera della compressione. Le lesioni distruttive polari possono essere trattate con la resezione parziale e quelle localizzate in una metà di un rene bifido con la eminefrectomia. Viene riferito un caso di colesteatoma associato a malattia policistica. Fu curato mediante nefrectomia e dilatazioni dell'uretere residuo. La guarigione si mantiee a 5 mesi di distanza.

## SUMARIO

O urologista deve estar alerta no sentido de distinguir a doença policística do rim

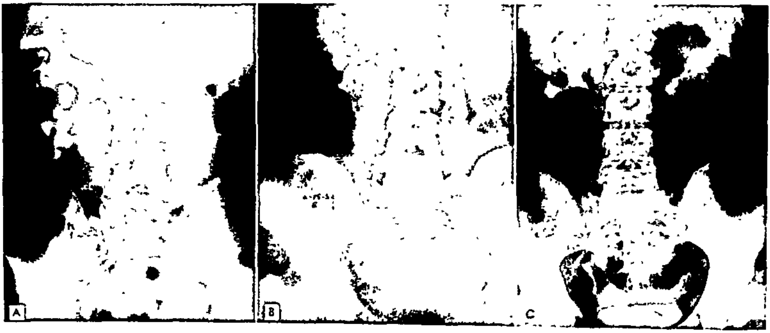

Fig. 4.—*A*, ureteropyelogram taken six months after nephrectomy of left kidney, showi complicating stricture of lower p kidney. *B*, ureteropy sho tricture of right lower ureter an d pyelectasis. Opposi v ovec for sclerosing calculous yelogram taken two t n i *B*. Note improvement resulting from periodic dilation of ureteral 2

da doença de Bright. O estudo pielográfico e arteriográfico excretor e retrógrado e a insuflação perirenal auxiliam o diagnóstico do rim policístico em muitos casos. O diagnóstico precoce permite o tratamento cirúrgico conservador. Em casos selecionados a retirada e a punção de cistos, a bisecção do rim, a descapsulação, a nefropexia e a simpatectomia retardam o desenvolvimento da doença, aliviam a dôr e prolongam a vida. A terapêutica adequada com antibióticos previne a infecção pós-operatória e a fístula renal. O urologista não deve exitar em realizar a operação conservadora antes do rim estar irreparàvelmente lesado. A nefrectomia deve ser feita nuando coexiste um tumor maligno, pionefrose, tuberculose, hidronefrose irreversível, pielonefrite difusa grave ou acentuada doença calculosa, provada a função do rim opôsto pela prova da concentração do nitrogênio não protêico (normal abaixo de 60 mg.). Depois da operação uni-lateral o rim policístico opôsto pode diminuir de tamanho.

O ezame meticuloso no sentido de verificar o concomitante estreitamento ureteral é importante. A drenagem ureteral realizada pela dilatação periódica do ureter, alivia a estase a retarda a destruição do parôenquima renal sempre lesado pela pressão devido ao desenvolvimento progressivo dos cístos.

Lesões destrutivas limitadas ao polo do rim policístico podem ser submetidas à nefrectomia parcial e aquelas incluindo metade de um rim bífido podem ser tratadas pela heminefrectomia, da mesma maneira que os pacientes sem doença policística.

O primeiro caso de colesteatoma complicando doença policística do rim, é relatado. Esta doença foi tratada pela nefrectomia seguida de dilatações do ureter remanescente. O paciente está bem dois anos e cinco meses depois da operação.

## RÉSUMÉ

Etant donné que la maladie polykystique du rein est souvent confondue avec la maladie de Bright, il est indispensable que l'urologiste soit sur ses gardes. La pyélographie descendante, la pyélographie rétrograde, l'étude artériographique, le pneumopéritoine aident au diagnostic de la maladie polykystique du rein dans la plupart des cas. Le diagnostic précoce permet un traitement chirurgical conservateur. Dans les cas judicieusement choisis, la décapsulation et la ponction des kystes, la néphrostomie, la néphropexie et la sympathectomie soulagent et prolongent la vie. Une technique correcte et le traitement aux antibiotiques préviennent l'infection post-opératoire et la fistule rénale. L'urologue ne devrait pas hésiter a pratiquer des opérations conservatrices avant que le rein soit irrémédiablement perdu. La néphrectomie devrait être faite lors d'une tumeur maligne co-existante, de pyonéphrose, de tuberculose, d'hydonéphrose irréversible, de pyélonéphrite diffuse incurable, de calculose progressive, a condition que la fonction du rein opposé soit normale comme le révèle la concentration de nitrogène non protéinique (normalement audessous de 60 mg). Après l'opération unilatérale le rein polykystique opposé peut diminuer de volume.

Un examen attentif en vue de rechercher un rétrécissement urétéral concomitant (qui existe en général) est important. Le drainage urétéral par la dilatation périodique de l'uretère, diminue la stase et retarde la destruction du tissu rénal déjà malade par la pression due au développement progressif des kystes.

Les lésions destructives limitées à l'un des pôles du rein polykystique peuvent être soulagée par une néphrectomie partielle, et celles comprenant la moitié d'un rein par une héminéphrectomie, comme on la pratique chez les malades qi ne sont pas atteints de maladie polykystique.

Le premier cas de cholestéatome comme complication de la maladie polykystique du rein est rapporté. Il fut traité par la néphrectomie suivie d'une dilatation répétée de l'autre uretère. Le malade resta bien portant pendant deux ans et cinq mois après l'opération.

## ZUSAMMENFASSUNG

Die häufige Verwechslung von polyzystischer Nierenerkrankung mit Brightscher Krankheit sollte den Urologen anregen, auf der Hut zu sein. In den meisten Fällen der polyzystischen Erkrankung bilden die exkretorische und die retrograde Pyelographie, die Arteriographie und die perirenale Lufteinblasung vertvolle Hilfsmittel in der Differentialdiagnose. Bei früher Erkennung der Krankheit gewinnt man die Möglichkeit der Durchführung konservativer chirurgischer Massnahmen. In sorgfältig ausgewählten Fallen kann man durch Stutzung und Punktion der Zysten, durch Spaltung der Nieren, durch Dekapsulation, Nephropexie und Sympathektomie das Fortschreiten der Erkrankung aufhalten, Schmerzen lindern und das Leben verlängern. Postoperative Infektionen und Nierenfisteln lassen sich durch sorgfältige Technik und durch antibiotische Behandlung vermeiden. Der Nierenchirurg sollte vor solchen konservativen Eingriffen nicht zurückschrecken, solange die Niere nicht unwiederherstellbar geschädigt ist. Nierenresektion sollte erfolgen, vorausgesetzt dass die andere Niere eine ausreichende Funktion zeigt (Reststickstoff, normal unter 60 mg!), in Fällen wo gleichzeitig eine bösartige Geschwulst, eine Nierenvereiterung, Tuberkulose, irreversible Hydronephrose, unheilbare diffuse Pyelonephritis oder ausgedehnte Steinerkrankung besteht. Nach einseitiger Operation kann es vorkommen, dass die polyzystische Niere der anderen Seite sich verkleinert.

Von grösster Wichtigkeit ist es, das gleichzeitige Bestehen einer Harnleiterverengung, die gewöhnlich vorliegt, durch sorgfältige Untersuchung zu erkennen. Durch periodische Dilatierung ausgeführte Drainierung des Harnleiters behebt die Harnstauung und verzögert die Zerstörung des durch den Druck der ständig wachsenden Zysten ohnehin geschädigten Nierengewebes.

Schädigungen, die auf einen Pol einer polyzystischen Niere beschränkt sind, können durch eine Teilresektion der Niere behoben werden, und, wo die Erkrankung eine Hälfte einer zweigespaltenen Niere befallen hat, kann eine Heminephrektomie in der gleichen Weise wie bei Kranken ohne polyzystische Erkrankung vorgenommen werden.

Es wird zum ersten Mal über einen Fall von polyzystischer Nierenerkrankung, der durch ein Cholesteatom kompliziert war, berichtet. Die Erkrankung wurde durch Nierenresektion und durch spätere wiederholte Dilatierung des verbleibenden Harnleiters behandelt. Zwei Jahre und fünf Monate nach der Operation befand sich der Patient in gutem Zustand.

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We must suspect malignancy or a premalignant character in all gastric ulcers first appearing after the age of forty; in all those in the prepyloric inch, and in other parts of the stomach that are not on or adjacent to the lesser curvature; in those exceeding an inch in diameter; in those that do not heal after a month's strict medical treatment in bed and in which occult blood is still found in the stools after such treatment. All these should be submitted to surgery without further delay.

I would conclude by repeating that the early diagnosis of cancer in any internal organ depends, in the main, on clinical judgment, on the early confirmation of what can, in most cases, be no more than a suspicion. We can all remember instances of a diagnosis of malignancy made on clinical grounds, of repeated examinations by experts giving repeated denials, of confirmation coming too late for curative treatment. To doubt is safer than to hope. And if our suspicions continue, if the weight continues to fall, we must insist on an exploration. There is more rejoicing in heaven over the one laparotomy that fails to find cancer than over the ninety-and-nine (positive ones) that find it too late.

—*Ogilivie*

# Surgical Drainage

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TO clarify my subject I must first quote two definitions from Webster: *Drain* means to *empty*, take out, evacuate. *Wick* (in the surgical sense) means an appliance to maintain permanence of a vent to *permit* escape of fluid or gas.

With these two definitions in mind, it is quite obvious that this article is not going to deal with wicks, since wicks do *not* produce drainage. Wicks (Fig. 2) are *not* drains and never have been drains.

It is impossible for me to comprehend why these two words, each with an entirely different definition, could have become so confused in the minds of educated scientific men, and how the two words could have continued to be so wrongly used since surgery was in its infancy. I also wonder how many surgeons—after reading this article—will continue to call a wick a drain, and how many will pause to consider the physics of the principle of drainage. At the close of this article (see *Drainage Problems*) will be found some basic reasons for the error in the use of the two words, with the principles of physics as applied to surgical drainage.

It is quite true that drainage is required much less frequently now than in the prepolychemistry days, but to a specific patient, proper drainage—which removes and takes out all toxic fluids—is the deciding factor between life and death.

It is very stimulating and refreshing to me to read letters sent me, voluntarily, by leading surgeons of the world, stating that they have saved thousands of lives since using the Chaffin suction drainage technic—lives that would have been lost had it not been used. I again refer my reader to the definition and the data at the close of this article.

Postoperative fistulas of bowel, gastrointestinal anastomosis and genitourinary fields are just as much of a problem now as always—*but* with suction drainage using either the regular Chaffin tube (Fig. 1) or the new smaller type (Fig. 4) known as the Chaffin suction catheter, these diseases can now be "cured" in days. I have had personal experience with 15 or 20 of these in this locality, and with a single result—*100 cured.*

One duodenal fistula had persisted for months. It had a maximum of 2 liters of bile and gastric fluid in twenty-four hours. This fistula had been treated by aspiration from an excoriated abdominal wall with a hand syringe, but after insertion of a Chaffin suction catheter (Fig. 4) in conjunction with a Pratt pump, it was "cured" in twelve days *at the patient's home.* I have had cases of immediate postoperative biliary fistula in my own service, in which the patient put out the total bile production—but only for five to eight days, then none.

May I call the reader's attention to a personally formulated axiom *Nature will not permit two openings in a hollow viscus at the same time, provided the normal one is adequate.* This means there must be no obstruction to the normal one, so that with the help of aspiration-drainage from the bottom of the well (fistulous tract), they will all close.

Morbidity is sometimes as important as mortality and should not be overlooked. But I regret to note that, in hundreds of surgical lectures rely any

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cussion of morbidity—*only* of mortality. All surgeons would all like to ask, "How sick was the patient? How long did it take him to recover? What caused his long period of morbidity?" A high percentage of *morbidity* will result from lack of prophylactic drainage—or therapeutic drainage to the existent sinus.

Now a few remarks illustrating the value of aspiration-drainage (not wick) as a surgical weapon in infection and leakage.

I began this study and work more than forty years ago and am very proud of the records. I found—by personal experience and that of others—that the mortality rate of peritonitis, in the prepolychemical era, compared favorably with the present rate—not including pneumonia, blood infection and other complications of the original disease. Cases studied in one large hospital, with operations performed by over 50 surgeons over a period of five years, showed not one patient going to the autopsy room when adequate aspiration-drainage was provided, as against scores of deaths when *wicks* and *vents* and sulfa closures were used (Fig. 2).

I have condemned the use of sulfa in the abdomen at all times, and I observed in the first year of its use as a dusting powder in the abdomen that the death percentage rose higher than at any previous or subsequent time.

One new and important surgical field in which aspiration-drainage is necessary is extensive resection for pelvic cancer. Suction drainage is now used by several splendid surgeons specializing in this field.

*The Technique of Aspiration-Drainage.*—First, discard all Penrose wicks. Put them away where they cannot be found by the operating staff.

Now—on the sterile table—have at least 2 Chaffin tubes, one plain and one with tails (Fig. 1*A*). The plain one is for preformed cavities, such as the gallbladder and the urinary bladder; it is also to be used instead of the Poole tube to aspirate the abdominal fluid at operation. It is better than the Poole tube in that it may be held in the palm of the hand during exploration of a pelvis, and rapidly removes fluid from all small recesses. Gangreneous gallbladders should have a tail tube under the gallbladder for the slough, and a plain one within, to aspirate the contents down to the very bottom. Remember, when a single tube is in a pus gallbladder, it is not *drained*—it is *vented.* In a few minutes the diseased gallbladder is just as full as it was preoperatively, only with less pressure. The "suction drained" gallbladder is *always* empty to its very bottom, and if it all sloughs away there can be no leakage, since there is no fluid to leak. The tailed tube amply protects the peritoneal cavity.

*The Dudodenal Stump.*—Can you always tell which one is going to leak? I cannot —so I protect *all.*

A tailed tube *near*—not in contact with —the stump will be standing by, actually waiting for the first appearance of fluid, and will suck it out and deposit it in the bottle—not leave it inside the patient. When this complication occurs the patient has *no reaction,* and the fistula will close as soon as the edema relieves the anastomotic obstruction. Subdiaphragmatic abscess will *never* occur if the surgical area is drained.

*Pancreatitis.* — Pancreatitis has been treated by multiple drains (Fig. 5) —not wicks—for thirty years, with a mortality rate far below any other method reported. Patients with pancreatitis have never been given the benefits of surgical treatment, nor has surgical treatment ever been tried. The explanation of this statement will be obtained by asking any of the older surgeons what they did for these patients. They will tell you they operated on them, looked, saw, and put in a wick (no treat-

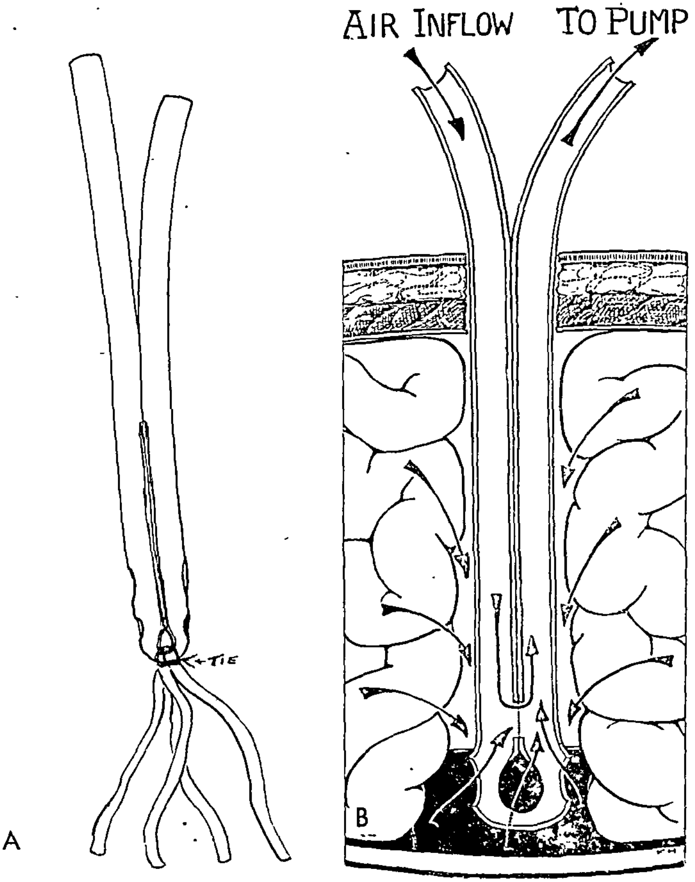

Fig. 1.—*A*, new type of tube now in use. Shows Penrose "tails" attached, which direct fluid to "low point" to be sucked out. This type of tube drains a wide area of infection and increases effectiveness of Chaffin tube in suction drainage. *B*, graphic illustration of a Chaffin tube in the abdomen, surrounded by loops of intestine. It is approximately 8 inches (20 cm.) long, with an inside diameter about [illegible] inch. Large arrows show direction of peritoneal secretion by gravity to lowest point—bottom of "well." Small arrows show fluid entering tube to be aspirated by pump. Air flows in freely in "open limb," through by-pass and out other limb, as shown. There is n uction yelets.

ment whatever). In a short time the abdomen was again full of enzyme fluid, and fat necrosis proceeded as before. But the surgeon questioned will probably say, "I drained it with a Penrose. What he saw on the dressing was the overflow—in the autopsy room he found the fluid that he should have removed by suction drainage. Now ask another if he has ever tried multiple drainage with two, three or four suction tubes. His answer will be "No." Therefore no surgical treatment has been tried.

I drain the gallbladder, incise the pancreatic capsule to relieve tension and open the retropancreatic space (through the gastrocolic omentum), place a suction tube at each of these sites, and immediately attach the Pratt double pump to one limb of each tube. The patient now has a chance with recognized supportive treatment. His peritoneal cavity will accumulate no more enzyme fluid.

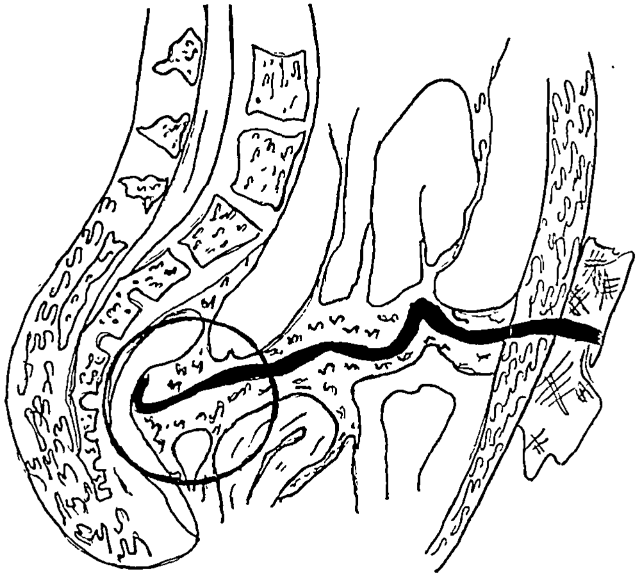

Fig. 2.—Sketch showing what a Penrose wick will *not* do in any abdominal cavity. Shaded area represents area collection of pus and serum flowing in every direction except "straight up." When the area is completely filled a small portion will overflow on the gauze. The pressure of this infected fluid at the bottom is 3 ounces per square inch on all surfaces. The area of infected tissue is increased many fold. This new infected area accounts for most postoperative fever and sepsis. A suction tube in this cavity prevents new infection and removes all secretion from the bottom. The fluid pressure at the bottom of this suction-drainage cavity is zero; hence no spread occurs, and there is no absorption.

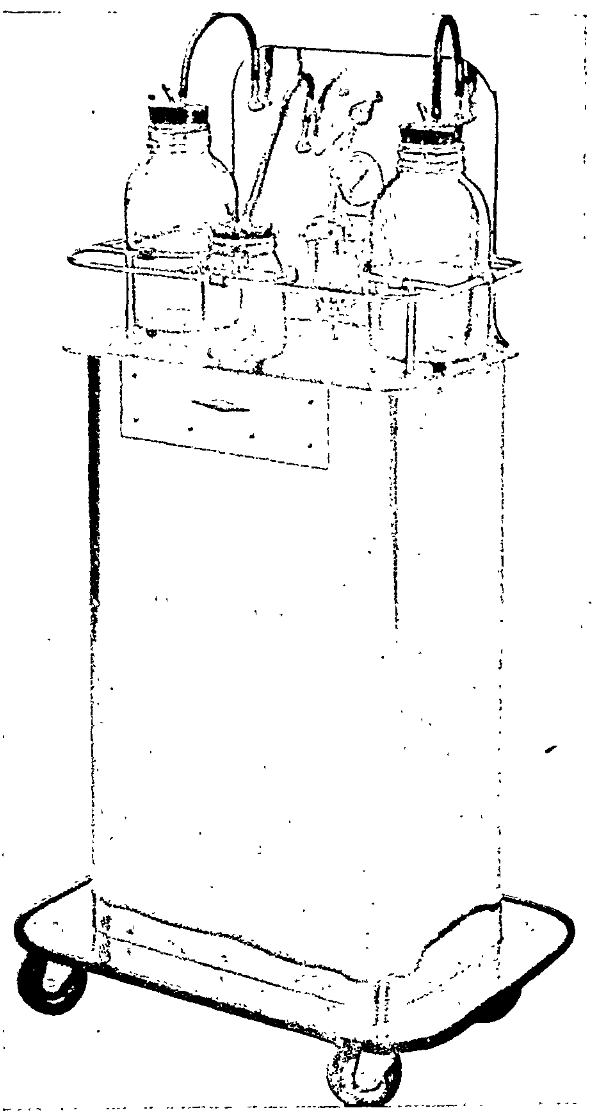

Fig. 3.—New bedside pump. Has two 2-quart collection bottles, with negative pressure equal to 30 inches of water (2 inches of mercury) suction on each. I use one for the nasal tube and the other on the Chaffin tube. If more Chaffin tubes are used, I attach another pump. There is a small bottle for "high suction" of mucous from the throat. A gauge shows the degree of suction at all times. The suction on the large bottle cannot be increased by the nurse. There is an automatic "shutoff" when the bottles overflow. The pump is constructed for continuous operation day and night for years without attention. It is silent, so that it does not disturb patients in a ward. This appliance completely covers the medical and surgical suction requirements of any hospital.*

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*Manufactured by E. O. Pratt Company, Los Angeles.

Fig. 4.—Chaffin suction catheter. This has the same physical properties as the Chaffin drainage tube except smaller diameter. There is a two-arm air-vent tube with a small arm for air intake. Fluids are sucked out through large arm to Pratt pump. This instrument is invaluable in the treatment of fistulas, including those of the duodenum, pancreas, biliary tract, bladder and colon, as well as many others; it is readily adaptable to thoracic surgical procedures, for intermittent aspiration and continous vacuum. The principle on which this tube is constructed has not permitted a "wet" suprapubic proctatectomy patient for thirty years. The catheter is also splendid in cholecystostomy. It is useful in all fields in which the secretion is thin fluid. If the secretion is pus or some other thick substance, the larger tube is necessary.

*Suprapubic Prostatectomy.*—Suprapubic prostatectomy is now done with greater safety and a lower morbidity rate than ever before. Over twenty-four years ago I wrote an article, "Always A Dry Patient"—and from then to now I have *never* had a wet patient. What other technic can equal that record?

Older surgeons can remember the genitourinary wards with scores of elderly postoperative patients lying in wet, odoriferous beds, swathed in wet dressings—all of which contributed to mortality and morbidity. That could all have been avoided had the surgical staff applied the physical principles of fluids, which the farmer knows so well, and had pumped (sucked) the urine into a collector bottle. I did just that—as early as 1907.

The technic of suprapubic enucleation I use is that of the late Dr. Vern Hunt, but the postoperative treatment is vastly different. Complete hemostasis is obtained by multiple ligation and suture; then two suction catheters are inserted. The suprapubic catheter (Fig. 4) exits through a stab wound of the bladder, and is for safety in case the penile one becomes occluded by a clot. The penile catheter is held at the proper level, not by a balloon, which is inadequate, but by a thread running from its tip out through the abdominal wall and tied, at the proper level, to a stick. With a Pratt pump attached to each air-vent tube (Chaffin suction catheter), all urine, including any blood that may be present, is collected—the color giving constant information. The suprapubic catheter is removed in twenty-four hours, and the other one is allowed to remain until the color of the urine is satisfactory (two to three days), and then removed. The patient is now able to leave the hospital (three to six days if physically able), and he has not been "wet." Also, he has had *double* protection against a possible clot in the bladder. The suction penile catheter keeps the bladder *completely* empty. Fifty tests on a single patient showed 3 ounces in a bladder with a passive catheter—but not a dram with the Chaffin suction catheter. This is most important in sutured bladders such as those resulting from multiple trauma and uretral transplants.

*Colon Surgery.*—I did primary anastomoses in colon resection—both right and left—some ten or fifteen years before the profession came out with the much publicized "anterior resection." The accepted technic for years was "exteriorization," and two or three stages were necessary because of the high incidences of peritonitis.

I was never concerned with peritonitis, for I learned over the years that if wicks are discarded and aspiration is used the peritoneum will resist infection to the utmost. As a result, I was able to do that type of operation as it is done today—and possibly more safely, because the young surgeons of today are taught to "go into battle with one weapon only"; then if "the gun jams," he is helpless. The present psychology of the young surgeon is that he is *afraid* to drain for fear of reflection upon his ability and skill. And yet a Chaffin standby drain will protect the patient against *all leakage infection.*

I have had probably a half-dozen leakages—but not one ill patient therefrom—and one to two weeks was the usual time required for the fistula to close. I have recently transplanted a number of ureters into a partially resected bladder for cancer, and I gave them the protection of drainage. In some cases a quantity of urine was transferred into the collection bottle, but the fistulas closed in a few days. One repaired ureter, sutured over an indwelling ureteral catheter, continued to leak into the Chaffin abdominal tube for ten days. When I put suction drainage on the catheter previously passed up to the renal pelvis, keeping the suction equivalent to about 6 inches of water (negative pressure), the urine from the Chaffin tube ceased immediately and the patient was well in one week.

In the orthopedic field I drain for one day in all amputation stumps, and have no moist dressing and no edema of the usual "pocket" under the posterior flap. (A principle of physics, that a wick will not draw water uphill.)

I usually place a tube in the hip nailing in obese patients for one or two days, and find that they do better.

In 1 case of the "old-fashioned psoas abscess" type of fistula, a young boy—after twelve previous operations—was recently operated on by a colleague, who inserted a Chaffin tube. The patient recovered rapidly, and has remained well. All previous operations were inadequate because only a wick had been used. The last operation was done by the same technic as before, the only difference being that drainage was used instead of a wick.

Since the passing of the old pneumonia empyemas, I do not perform chest operations. The present-day thoracic surgeons, however, are gradually learning that *serum won't run uphill,* and are now using the suction catheter to keep the cavity dry, thus maintaining constant negative pressure with the Pratt pump. I used intermittent closed suction in cases of empyema forty years ago, and my incidence of chronic pleural fistulas was much less than with other forms of treatment. The negative pressure expands the lung early. A tube immersed in water in a bottle is good—but not the best. That negative pressure is furnished by the patient, and with *no* help from the doctor. It is the normal negative pleural pressure. The patient should have more than that. Supply the extra pressure with a pump, and

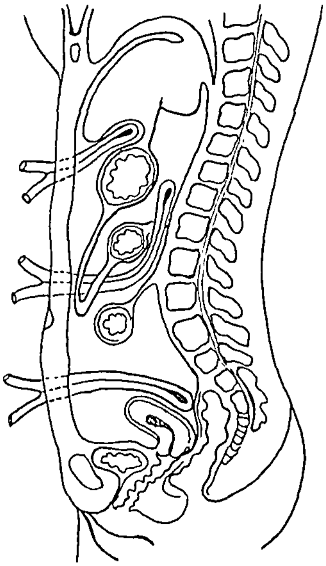

Fig. 5.—Location of suction drains in abdomen with acute pancreatitis. Sketch shows, from top to bottom, liver space, lesser peritoneal cavity and pelvic drain. Suprapsoas reservoir may also be drained by other tubes through stab wounds if these are found to contain peritoneal fluid. One limb of each tube is attached to pump for suction.

greater lung expansion will occur early.

Much more could be and has been written on this subject, but I shall not burden my readers with more. All claims made in this article are *ultraconservative.* I ask —I beg of you—never again to call a wick a drain. If you must use a wick, call it by its proper name. And please do not present statistics on drainage when you did not use drainage in a single instance.

*Drainage Problems.*—First of all, let's remember that fluids can not run uphill. Now for our definitions once more:

*Drain* — to empty — take out, remove, evacuate.

*Wick* — an appliance to maintain permanence of a vent to *permit* escape of fluid or gas.

Here's the mechanical side of the drainage problem:

1. A farmer uses a suction pump to withdraw water from his well.
2. An engineer uses a suction pump to drain a reservoir in the basement of a house.
3. A captain of a boat uses suction to empty a leaking boat; a deep sea fisherman uses suction to pump out bilgewater.
4. Oil well drillers use a suction pump in their sump holes—sump drainage.
5. A sanitary engineer uses suction to pump out the cesspool.
6. An auto engineer uses suction to pump gas from tank to carburetor.
7. Miners have "stand-by" suction in case of tunnel leakage.

All the foregoing groups use drainage correctly.

Here's how too many surgeons handle similar problems:

1. Surgeon A still uses *his* gauze wick in pelvis.
2. Surgeon B still uses a cigaret wick in deep cavities.
3. Surgeon C still uses a plain tube for overflow when the cavity is full.
4. Surgeon D still uses a rubber wick (Penrose) in all *his* fields.
5. Surgeon E does not even vent *his* cesspools—hopes they will become sterile and absorb.
6. Surgeon F tries to use gravity, but this is not available and the vent won't remain open (combined abdominoperineal resection).
7. Surgeon G still uses a stand-by wick in *his* colon resection—"leaking tunnel."

Except for 5 and 6, who use nothing, each of the above group uses a wick, yet they call it *drainage.* This not only is an entirely misleading statement but an incorrect statement. Wicks are *not* and *never have been* drains.

Most hospitals now have facilities for suction drainage, and if not it is readily procurable. The Pratt pump has been made specifically for this technic and is now in use in scores of hospitals throughout the world.

## SUMMARY

Surgical drainage (not wick) is the most valuable weapon procurable against infection and leakage.

Since the two Chaffin tubes have been designed and the manufacturers have made a practical, troubleproof pump, the technic of drainage is greatly simplified. It saves the patient "after it happens" and guards the site "before it happens."

Simply place a Chaffin tube (Fig. *A*) instead of a wick. Attach the pump and permit a drip to go into the open end to keep the tube clean. No dressings are necessary. There is no soiling, no infected incision and no excoriated abdominal wall.

## RESUMEN

La canalización quirúrgica es el recurso más importante contra la infección y el derrame.

Ya que los dos tubos de Chaffin han sido diseñados y los fabricantes los han convertido practicamente en un dispositivo de bombeo que no falla, la técnica para canalización se ha simplificado grandemente. En conclusión se les considera acción preventiva y curativa.

Se coloca simplemente un tubo de Chaffin, se conecta la b[illegible]a y se d[illegible]ear por el e[illegible] h[illegible]uidán

pieza del tubo, no se necesitan apósitos, no hay contaminación ni infección de la herida, ni escoriaciones de la pared abdominal.

### RIASSUNTO

Il drenaggio chirurgico è la misra terapeutica con cui più validamente ci si può opporre all'infezione e allo scola dei liquidi. Da quando sono stari ideati i due tubi di Chaffin ed è stata costruita una pompa pratica e non molesta, la tecnica del drenaggio ne è risultata semplificata al massimo grado. L'apparecchio è utile sia per la cura che per la prevenzione degli stati patologici sopra detti. Si tratta semplicemente di sistemare il tubo, attaccare la pompa e far scorrere del liquido goccia a goccia per mantenere il tubo sgombro. Non vi è bisogno di medicazione, non vi è imbrattamento nè infezione delle ferite o escoriazione della parete.

### SUMARIO

A drenagem cirúrgica ("not wick") é o método mais eficiente contra a infecção e deiscência.

Desde que os 2 tubos de Chaffin entraram na prática, a técnica da drenagem foi simplificada ao extremo.

Coloca-se simplesmente um tubo de Chaffin (Fig. 1*A*), mantendo a luz do tubo desobstruida. Não há necessidade de curativo nem maior contaminação da parede abdominal.

### RÉSUMÉ

Le drainage chirurgical (et non par la mèche) est la meilleure arme contre l'infection et la suppuration.

Depuis l'invention des deux tubes de Chaffin et depuis que les fabricants l'ont améliorée par une pompe perfectionnée, la technique du drainage est simplifiée. Il sauve le malade une fois l'infection déclarée et préserve l'endroit de l'infection.

Placez simplement le tube de Chaffin (Fig. 1*A*), au lieu d'une mèche. Fixez la pompe et laissez passer au travers un goutte-à-goutte afin de maintenir le tube propre. Aucun pansement n'est nécessaire. Il n'y a pas de souillure, pas d'incision infectée et pas d'excoriation de la paroi abdominale.

### ZUSAMMENFASSUNG

Die wertvollste Waffe, die uns im Kampf gegen Infektionen und Undichtigkeiten zur Verfügung steht, ist die chirurgische Drainierung—nicht de Gazetampon.

Seit der Erfindung der beiden Chaffin-Schläuche und seit der Einführung einer praktischen störungsfreien Pumpe durch die Fabrikanten ist die Technik der Drainage unendlich vereinfacht worden. Das Verfahren führt zur Rettung des Kranken, wenn etwas passiert, und schützt die Stelle des chirurgischen Eingriffs, bevor etwas passiert.

Man legt einfach anstatt eines Gazetampons einen Chaffin-Schlauch ein (Abb. 1*A*). Man schliesst die Pumpe an und lässt einen Tropfeinlauf in das offene Ende des Schlauches hineinfliessen, um ihn sauber zu halten. Verbände sind unnötig. Es kommt zu keiner Verschmutzung, zu keiner infizierten Einschnittswunde und zu keiner Abschürfung der Bauchwand.

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# Tumor of the Glomus Jugulare Resembling Brain Tumor

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TUMOR of the glomus jugulare is an entity of fairly recent recognition, having been first described by Rosenwasser[1] in 1945. By 1948 Lattes and Waltner[2] were able to collect 18 cases. In 1953 Bickerstaff and Howell[3] assembled some 94 cases. Such a rapid acceleration in the recognition of this disease would indicate that the tumor is far more common than was originally supposed. In fact, Dockerty, Love and Patton[4] stated, "By this time it became apparent that many reported so-called angiomatous polyps and hemangioendotheliomas of the middle ear, were in reality examples of this new type of tumor."

In the past most of the cases have been reported by otologists, because in the vast majority the tumors have presented in the ear. In fact, as Henson, Crawford, and Cavanagh[5] pointed out, 3 such cases have been reported by neurosurgeons: Poppen and Riemenschneider[6], Dockerty, Love and Patton[4], and Alexander, Beaver and Williams.[7] In almost all of the cases reported there was a history of discharge or bleeding from the ear, with a tumor seen on otoscopic examination or a tumor of the neck. Bickerstaff and Howell[3] reported only 4 cases in which the neurologic manifestations appeared before aural symptoms, and in only 1 (Revilla) no aural polyp or discharge was ever noted. The case to be presented, therefore, in which there were no such manifestations and in which the first symptoms were observed elsewhere, may be of interest.

## REPORT OF CASE

M. M., a 46-year-old Negro, had begun to have headaches in the occipital area on the left some seven years before examination. Approximately one year before examination he noticed hoarseness, and shortly thereafter found difficulty in swallowing. At about the same time he noticed a "noise" in the left ear, and deafness came on gradually and progressed on that side. In one month after it was first noticed the deafness had become complete. Three weeks before examination the patient had double vision and noticed that his eyes were crossed. He also became aware of a stiff, painful neck and on one occasion became confused and disappeared for three days in an amnesic state. Examination by an otologist gave no evidence of a causative agent in the ear canal.

Examination showed the patient to be well developed and nourished. He carried his head tilted to the right. There was definite restriction of motion in his neck, due to pain. The pain was principally occipital, with some radiation towards the vertex and down into both trapezius ridges. The fundi showed some pallor of the optic discs and some distention and tortuosity of the veins, but no papilledema. There was paralysis of the sixth through the twelfth cranial nerves on the left. The external auditory meatus showed no evidence of disease. There were no abnormalities of the pyramidal tract.

Roentgenograms of the skull showed extensive erosion of the base of the posterior fossa on the left, extending into the foramen magnum (Fig. 1A). There was also an appearance of partial destruction of the dorsum sellae (Fig. 1B). A diagnosis of possible meningioma of the posterior fossa on the left was made, and suboccipital craniotomy was performed.

On operation a small nodule the size of the tip of one's litt[illegible] found d[illegible] under the [illegible] it t[illegible] up into the [illegible]

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for biopsy. A great mass of tumor, however, appeared to be extradural and to lie on the floor of the posterior fossa on the left, extending almost to the midline from underneath the fifth nerve, back almost to the foramen magnum. The dura was split, and an effort was made to remove part of the tumor, but the hemorrhage was so violent that the attempt had to be abandoned. In view of past reports, an operative diagnosis was made of probable tumor of the glomus jugulare, and this was confirmed by biopsy (Fig. 2). The specimen was examined at the Emory University Department of Pathology by Dr. P. Navarro. The patient was referred to the roentgen department for therapy, but died.

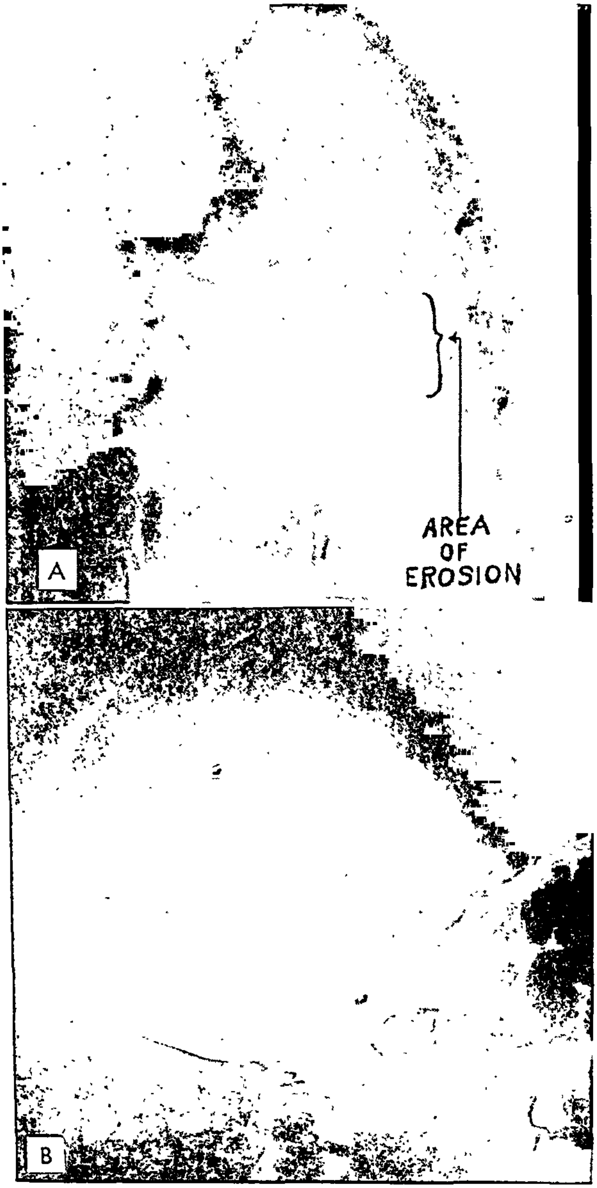

Fig. 1.—Roentgenograms of the skull of M. M., a 54-year-old Negro. *A*, erosion of base of posterior fossa on left, extending into foramen magnum. *B*, appearance of partial destruction of dorsum sellae.

This case illustrates the difficulty of differential diagnosis when no tumor mass presents in the ear. The roentgen characteristics were pointed out by Reimenschneider, Hoople, Brewer, Jones and Ecker[8] in 1953 and confirmed the presence in such cases of mass destruction of bone in the posterior fossa, including the petrous ridge. From time to time differentiation must be made from acoustic neurinoma, primary tumor of the nasopharynx, chordoma, carcinoma of the sphenoid sinus and angiomatous meningioma, as well as metastatic tumor. The glomus jugulare receives its blood supply from the ascending pharyngeal artery; therefore, as with other conditions, external carotid angiographic study is sometimes superior to other angiographic procedures in delineating the lesion.[9] Vertebral angiographic study has been recommended by Riemenschneider and others[8] and is said to show tremendous vascularity of this tumor, not characteristic of other tumors.

Although the mortality rate has been high in the past, cases of survival for as long as thirty years after the onset of symptoms have been reported, according to Henson, Crawford, and Cavanagh.[10] A note of optimism has appeared in the reports by Alexander and Adams[10] and by Henson and others[9] of successful treatment with roentgen therapy. Henson also apparently obtained improvement by the implantation of radon seeds, and mentioned ligation of the external carotid artery on the same side as an adjunct to therapy. Winship, Godwin, and Van Creveld,[11] looking to the future, expressed the opinion that the mortality rate can be drastically reduced if the diagnosis of the

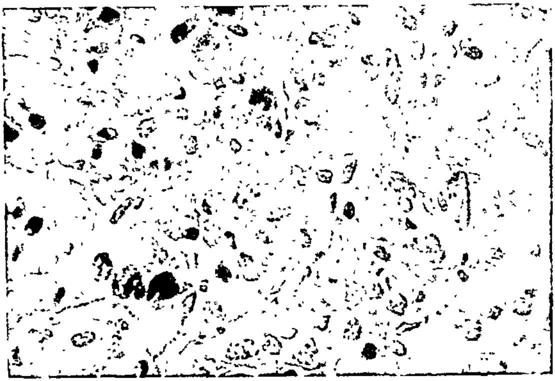

Fig. 2.—Photomicrograph of biopsy specimen confirming tentative diagnosis of tumor of globus jugulare.

condition is made earlier. They suggested that, because of that predominant sexual characteristics of the tumor, endocrine preparations may be tried.

### SUMMARY

An unusual case of tumor of the globus jugulare, with symptoms limited to the posterior fossa and without abnormalities in the ear canal is presented. The similarities and dissimilarities to brain tumor lodging in the posterior fossa are described. New suggestions for therapy, as presented in the recent literature, are reviewed.

### RESUMEN

Se presenta un caso raro de tumor del golfo de la yugular con síntomas localizados a la fosa posterior y sin anomalías en el canal auditivo. Se describen las semejanzas y diferencias respecto a tumor cerebral ubicado en la fosa posterior. Se revisan nuevas sugestiones para la terapeúticas en relación con la literatura reciente.

### RIASSUNTO

Viene descritto un insolito caso di tumore del glomo giugulare con sintomi limitati alla fossa posteriore e senza alterazioni del canale uditivo. Vengono sottolineate analogie e differenze presentate dai tumori cerebrali situati nella fossa posteriore. Viene rivista la recente Letteratura sui nuovi concetti terapeutici.

### RÉSUMÉ

L'auteur présente un cas rare de tumeur intercarotidienne, avec symptômes limités à la fosse postérieure et sans anomalies du canal auriculaire. Il fait le diagnostic différentiel avec les tumeurs cérébrales de la fosse postérieure. Les nouvelles suggestions thérapeutiques mentionnées dans la littérature sont analysées.

### SUMARIO

Um caso raro de tumor do [illegible] us jugular [illegible] limitado [illegible] rior [illegible] ade do apresentado. As semelhanças e diferenças com o tumor cérebro localizado na fossa posterior são descritas. Novas sugestões terapêuticas são referidas.

### ZUSAMMENFASSUNG

Es wird über einen ungewöhnlichen Fall einer Geschwulst des Glomus jugularis berichtet, in dem die Krankheitserscheinungen auf die hintere Schädelgrube begrenzt waren und keine krankhaften Veränderungen im Gehörkanal bestanden. Es wird auf die Unterschiede und die Aehnlichkeiten mit Hirntumoren in der hinteren Schädelgrube hingewiesen. Der Verfasser gibt einen Ueberblick über neue in der jüngsten Literatur dargestellte Vorschläge zur Behandlung.

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The true rule, in determining to embrace or reject anything, is not whether it have any evil in it, but whether it have more of evil than of good. There are few things wholly evil or wholly good. Almost everything, especially of government policy, is an inseparable compound of the two, so that our best judgment of the preponderance between them is continually demanded.

—*Lincoln*

The final wall of the wise man's thought is human kindness. If the road of disappointment, grief, pessimism is followed far enough, it will arrive there. Pessimism itself is only a little, little way, and moreover it is ridiculously cheap. The cynical mind is an uneducated thing. Therefore do I strive to be as kind and as just as may be to those about me, and in my meager success at it I find the solitary pleasure of my life.

—*Crane*

# The Painful and Stiff Shoulder

## A Plan of Treatment Based on Known and Theoretical Factors; Plea for Standardization in Evaluation of Results

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FOR many years confusion and disagreement have existed with regard to the pathologic character and the treatment of a painful, stiff shoulder. The syndrome of severe progressive pain in the shoulder in a person of middle or advanced age, which progresses in spite of recommended forms of treatment, is a frequent and annoying problem. The multiplicity of different treatments recommended in the literature indicates that no one treatment has been satisfactory. There is almost total ignorance of the pathogenesis, as well as minimal information as to the pathologic picture, and consequently the diagnosis is difficult. Finally, writers on the subject are at variance as to what constitutes a satisfactory result.

The purpose of this paper is to attempt to review and coordinate the experience of all writers and evolve a logical plan of treatment. A proposition will be made to standardize the results, so that proper evaluation of the treatment can be obtained.

*Historical Background.*—The term "periarthritis" was first used by Duplay in 1872 to describe the condition now called "frozen shoulder." In 1907, Baer and Painter recognized the presence of calcified deposits in the musculotendinous cuff. Codman made the first intensive study of the shoulder and gave the first clinical picture of the frozen shoulder. He regarded this condition as due to an adhesive subacromial bursitis and later described the pathologic picture as that of a tendinitis of the rotator cuff without calcification. During the past decade, the literature has become abundant with the observations of various writers regarding the nature of this condition. Lippman, DePalma, Moseley, Inman, Saunders and Abbot, Neviaser and others have written profusely on the shoulder from the pathologic and mechanical points of view.

*Pathologic Studies.*—The first intensive pathologic study was made by Horowitz in 1939. He dissected 150 shoulder joints of cadavers, the average age at death being 55. He noted various changes in the soft tissues, including chronic bursitis with thickening, villous formations, and communication with the joint cavity through defects in the cuff; the superficial aspect of the cuff was frayed and fibrillated. The biceps tendon in 75 specimens was constricted within the groove but otherwise was normal; in 30 instances this tendon was slackened, thinned, frayed, fibrillated and torn, these changes being associated with bony changes about the tubercles and the bicipital groove. These 30 cases greatly exceed the usual incidence of frozen shoulder in a comparable number of persons in this age group studied. When the tendon was interrupted (4 cases), the proximal end of the distal fragment had been separated out of the groove and attached to the lesser tubercle. In 1

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case the proximal portion was completely absent. In another the proximal portion had become fixed to the articular surface of the humerus. In the remaining 2 cases there was a small stub attached to the supraglenoid tubercle. In only 1 of these cases was the tendon bound down to the groove by adhesions. The bony changes consisted of proliferation of the greater and lesser tuberosity and the margin of the groove, which changes seemed proportional to the soft tissue alteration. In certain instances a large defect in the cuff exposed the greater tuberosity, which had receded and was atrophic. Similar changes were observed on the undersurface of the acromion, evidence of continued friction. Also, in these cases, the articular cartilage was degenerate, and marginal lipping was noted at the superior and anterior borders of the acromion.

Neviaser, in 1944 and 1945, reported that the essential pathologic manifestations were thickening and the formation of adhesions about the capsule, particularly at the inferior aspect. He examined 63 shoulders at operation and observed evidence of tenosynovitis of the long head of the biceps in only 1 case. This observation is in marked contrast to those of others. He stated that cutting the inferior contracted capsule and the adhesions that had formed between the head and the capsule immediately freed the shoulder motion. This too, is in marked contrast to the observations of Lippman and DePalma, who stated that "removal of the intraarticular portion of the biceps was sufficient to free the shoulder movement immediately." However, Neviaser agreed with these observers that microscopically the cuff shows evidence of an inflammatory process which includes degeneration of the collagenous tissue, increased vascularity, cuffing of the blood vessels, and infiltration of mononuclear cells. He employed conservative treatment in these cases (gentle manipulation) and observed complications in 2, a dislocation and a fracture respectively. His list of surgical indications includes recurrence, postdislocation shoulder, postfracture shoulder, and bony atrophy on roentgen examination, although he did not elaborate his comments with regard to the last mentioned. He reported 6 cases in which "satisfactory" results were obtained after operation. All patients had almost complete relief from the persistent pain that had existed prior to operation. With relief, they were willing to use the arm more freely to regain the full motion. To quote directly, "This alone makes the operation worth while," since it implies that the full range of motion was not obtainable at the operating table. This coincides with my own experience.

McLaughlin in 1944 described repair of the cuff in 75 patients who had disabilities or symptoms sufficient to warrant repair. Although over 3,000 patients presented themselves for painful shoulder, McLaughlin did not state whether they had the signs and abnormalities accepted as typical of frozen shoulder. In his operative procedure he chose a transacromial approach and discarded the outer fragment of the acromion. The results were uniformly good. Only 2 patients had slight limitation of abduction, and 5 had slightly limited internal rotation. DePalma, on the other hand, expressed the opinion that loss of the outer fragment is followed by difficult rehabilitation and adverse results.

In 1949 DePalma, Callery and Bennett reported on the different variational anatomic pictures and the degenerative lesions observed in the joints. The description is limited mainly to the scapular side of the joint and the capsule. The degenerative changes were shown to start as early as the second decade and to progress until they were maximal in the sixth. At first, unevenness, fibrillations and furrows were noted; later there were pitting, erosion and marginal bone proliferation. The subchondral bone became exposed in many instances, predominantly in the center of the glenoid cavity, where the greatest amount of compression exists during motion. The labrum glenoidale, because of its intimate attachment to the biceps tendon and capsular ligaments, is subjected to stress and strain during normal shoulder function; therefore the degenerative changes occur in this area very early. These consist of labral detachments, thinning scalloping, undulations, synovial tabs and fringes. The first significant changes in the biceps tendon were noted about the fifth decade, and these existed concurrently with degenerative lesions of the fibrotendinous cuff, consisting of thickening, widening and shredding. The author's interpretation was that the capsule degenerates and the biceps is forced to act as one of the main supports of the upper extremities. Therefore, it is subjected to great attritional forces, which are responsible for alterations in these tendons. The defects in the capsule were observed near the distal insertion of the supraspinatus and subscapularis tendon and at first existed on the synovial side. When the lesion became more extensive, the entire thickness of the capsule was involved. Just proximal to the defect the synovial tissue was thickened. The changes were less severe as the distance from the "critical zone" increased. Microscopically the same characteristics as had been noted by previous writers were described, such as tearing, fraying, degeneration of collagenous fibers, increased vascularity, and fibrosis. All shoulders showed these changes in patients beyond the third decade and were greatly progressive with advancing age. In the authors' opinion the capsule is subjected to repeated injuries and compression between the capsule and the acromion. DePalma stated that the adherence of the bicipital tendon is the main etiologic factor in production of the frozen shoulder.

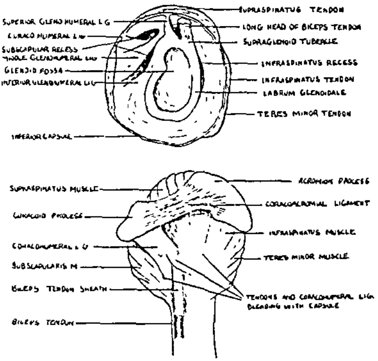

Fig. 1.—*Above*, glenoid aspect of shoulder joint. Note multiple plications and redundancy of capsule and its intimate relation with tendons of rotator muscles. Bicipital tendon attaches to the cartilaginous labrum and upper bony rim. *Below*, anterolateral view of subdeltoid structures. Note close approximation of coracoacromial ligament to the jacent capsule.

Lippman in 1941 stated that the bicipital tendon was very probably the instigator of the condition. He stated that capsulitis of the shoulder subsides promptly after the recession of the tenosynovitis. Recurrences do not develop after the biceps mechanism has been destroyed by fixation, and Lippman considers this ample evidence that the bicipital tendon is the cause. He stated that it is not necessary to remove the intra-articular portion of the tendon at operation, because it atrophies after fixation of the tendon. Surgical treatment is generally used only for those patients who require an early return to work, and the usual convalescent period is about four months. Lippman condemned excision of the acromion because it considerably prolongs the convalescent period. He concluded that a benign outcome is practically assured th com-
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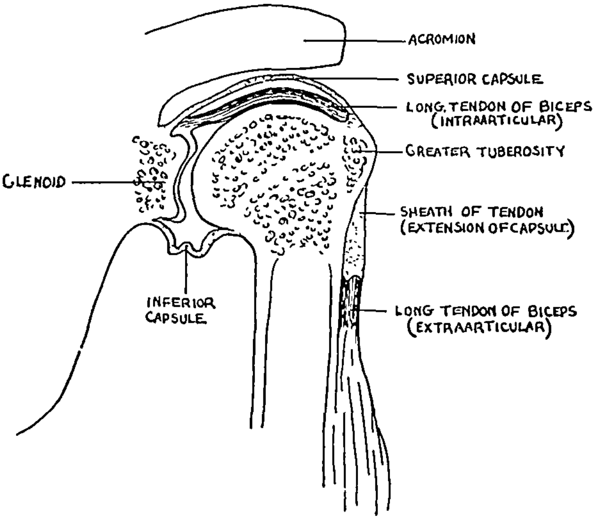
ACROMION
SUPERIOR CAPSULE
LONG. TENDON OF BICEPS (INTRAARTICULAR)
GREATER TUBEROSITY
GLENOID
SHEATH OF TENDON (EXTENSION OF CAPSULE)
INFERIOR CAPSULE
LONG TENDON OF BICEPS (EXTRAARTICULAR)

Fig. 2.—Frontal section through shoulder joint. Acromion, superior capsule, biceps tendon and humeral head are actually in close contact in resting position but are shown as separated structures for clarity.

dicate that the process is basically a traumatic one, due to compression of soft tissue between the head of the humerus and the acromion superimposed upon a degenerative and inflammatory lesion. Whether the degeneration as seen under the microscope is a naturally occurring process, not dependent upon external factors, is a moot question. The loss of the elastic component of connective tissue and the building up of the inelastic fibrous contracting tissue is a process that occurs with advancing age. Direct trauma to any mesodermal tissue is followed by a reactive inflammatory condition, the microscopic picture of which is identical with the aforedescribed lesions. The pathologic picture is always most intense where compression is greatest and less intense at a distance from the traumatic zone. However, by continuity, the process may spread distally along the synovium and capsule to the biceps coverings. The healing granulations that invade the traumatized areas bring fibroblasts in their wake, with the result that excess fibrous tissue and, consequently, adhesions are formed. Toxic, metabolic and infectious factors, as additional exciting causes, await future investigations.

*Mechanical Studies.*—The earliest record of the action of the short rotator muscles of the shoulder was published by Stevens (1909). He noted that weakness of the rotator muscles allows, during abduction, an upward thrust of the head against the inferior surface of the acromion, thereby subjecting the soft tissues to compression.

Inman, Saunders, and Abbott made a study of the function of the shoulder joint in 1944. In a comparative anatomic study they noted that the deltoid became more massive and the supraspinatus and biceps became less important as abductors. The muscles situated below the scapular spine and acting on the humerus became more important by establishing the necessary components of a force couple. These muscles act with the deltoid in bringing about the rotary motion necessary for elevation. The upper trapezius, the upper serratus and the levator angulae scapulae produce components of a similar force. The elongation of the inferior angle of the scapula, together with minor migration of muscle masses, such as the teres minor, has accomplished the twofold object of forming the depressor group of the glenohumeral joint and at the same time increasing the lever arm for action of the lower trapezius and serratus muscles as a rotary unit of the scapula. The deltoid insertion migrates distally. The acromion becomes more massive. These authors showed that elevation of the arm in the coronal or frontal plane is dependent on free motion in all joints of the shoulder complex, occurring simultaneously through all phases of this motion. Maintenance of rhythm and smooth motion required an intact joint and preservation of power in the muscles that move it.

In elevation, early, the sternoclavicular joint passes through its greatest range of movement; in the later arc, the acromiolavicular. Arthrodesis of either will cause orresponding restriction of abduction.

These authors also demonstrated that hort rotators act as depressors of the umeral head. Without them the deltoid s helpless. Transplantation of muscles to ubstitute for the deltoid is useless uness accompanied by transplantation of the atissimus dorsi and teres major to the osteroinferior aspect of the greater tuerosity, thereby avoiding impingement of he tubercles and the head of the humerus gainst the acromial arch. If the latisimus and teres major muscles are absent, ixation of the humeral head by utilizing the long head of the biceps attached to the cromion in a modified Nicola procedure will give some stability to the head.

The importance of this work is obvious. It becomes evident that without the depressor effect of the short rotators and also, as will be shown, the action of the biceps muscle, and the rotary and stabilizing action on the scapula, the deltoid becomes less effective, and the result is an upward thrust of the humeral head against the acromion. DePalma makes very light mention of the effect of the long tendon of the biceps in producing rotary movement at the shoulder. As will be noted in the illustration, the biceps muscle has an important shoulder function. When the muscle belly contracts, the result at the distal end is flexion of the elbow and supination of the forearm. At the upper end the long tendon of the biceps becomes taut and depresses the humeral head. Roentgen films taken during active contraction of the biceps against resistance, reveal that there is marked widening of the space between the humeral head and the acromion. This indicates that the biceps is a very important muscle in depressing the humeral head during the act of abduction or forward flexion.

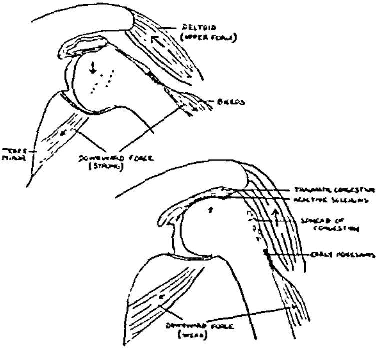

Fig. 3.—*Above*, normal mechanics of abduction at glenohumeral joint. Size of arrows indicates relative strength of force. Sum total of downward force of infraspinous muscles and long head of biceps and upward outward deltoid force is a strong downward thrust of the humeral head. *Below*, abnormal mechanics leading to chronic capsular trauma. Depressor effect of biceps and infraspinous muscles is minimal or nonexistent. Result is an upward thrust of the humeral head as deltoid contracts. Repeated compression of capsule about greater tuberosity leads to capsular congestion, bony sclerosis, and recessional changes in tuberosity.

*Theory of Pathogenesis.*—The shoulder is a closely fitted joint, anatomically speaking. The humeral head barely fits a glides beneath the coraco-acromial arch. When one examines this motion at operation, with the region under local anesthesia, one is impressed by the close contact of the humeral head and tuberosities, which are closely approximated to the acromion and the very rigid, sharp-edged coraco-acromial ligament. In order that the tuberosity prominences may proceed beneath the arch, the head is depressed inferiorly away from the arch by the contraction of the biceps, whose long tendon passes over the humeral head, in close contact with it, and attaches itself to the supraglenoid tubercle. The rotator cuff, which envelops the superior aspect of the head, acts similarly in depressing it, but also fixes it against the glenoid, while the deltoid abducts the arm.

From a study of the pat ic cture as outl erature ing

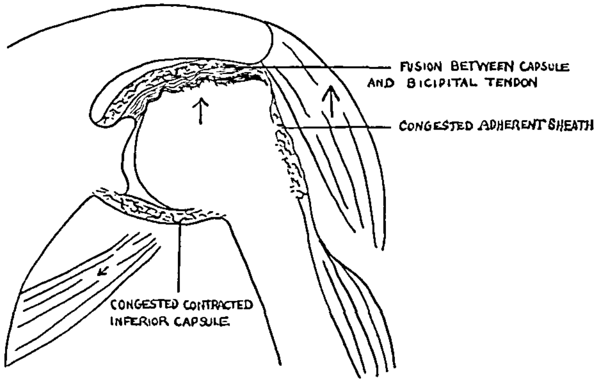
FUSION BETWEEN CAPSULE AND BICIPITAL TENDON
CONGESTED ADHERENT SHEATH
CONGESTED CONTRACTED INFERIOR CAPSULE

Fig. 4.—Stage of severe contraction. Superior capsule and bicipital tendon are swollen and adherent to humeral head and groove. Inferior capsule is thickened and contracted. Deltoid power cannot overcome obstructing subacromial tissues and tight inferior capsule.

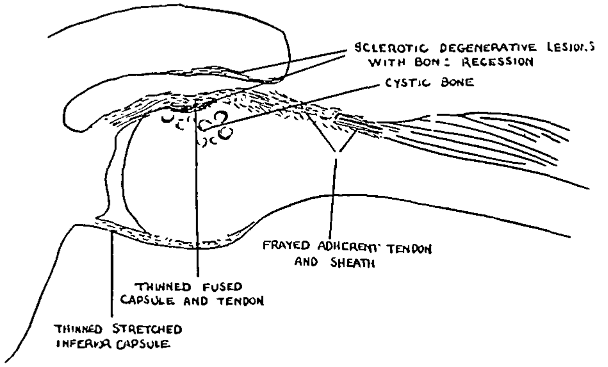
SCLEROTIC DEGENERATIVE LESIONS WITH BONE RECESSION
CYSTIC BONE
FRAYED ADHERENT TENDON AND SHEATH
THINNED FUSED CAPSULE AND TENDON
THINNED STRETCHED INFERIOR CAPSULE

Fig. 5.—Final stage. Repeated attempts at abduction have worn down the soft tissues and caused sclerotic and cystic changes in the adjacent bone. The inferior capsule has stretched.

chain of events may be theorized: The basic mesodermal tissues are degenerate, in that they lack the elastic component and are subject to degeneration caused by direct trauma and also by some constitutional impairment that becomes prominent with advancing age. A defect in the mechanism of the shoulder becomes operative when the muscle, namely, the short rotator infraspinous muscles and the biceps muscles, become weakened in their efforts to depress the head. This may result from some intramuscular lesions or, more probably, reflexly from some factor within the joint. This disturbance of the muscle force couple allows an upward thrust of the humeral head during abduction, thereby causing compression of the soft tissue between the head and the acromion. The maximal point of compression exists between the prominence of the humeral head, namely, the greater tuberosity, and the acromion, the compressed tissue being located just proximal to the greater tuberosity. This is the "critical zone" of Codman and is the site of the many degenerative lesions described by DePalma, Collery and Bennett. Reactive edema and congestion of the traumatized site further increase the thickness of tissues that must pass under the rigid coracoacromial arch, thereby subjecting it to further trauma and resulting in more congestion and edema. A vicious cycle is inaugurated. The continuing of traumatic irritation results in the invasion of granulation tissue to remove the degenerative tissues and an attempt at repair by the fibroblastic process. This results in the formation of adhesions about the area. An extension of the process proceeds distally from the traumatized site by way of the extension of the synovium and capsular sheath down the bicipital groove. Because the capsule, with its degenerative changes of advancing age, has lost its elasticity, it contracts in areas where the normal redundancy is usually preserved by constant stretching of normal motion. This contraction is more likely to occur where the redundancy is greatest, so that the synovial walls are approximated and adherent. Thus are explained the pathologic changes observed in the inferior capsule by Neviaser. Continued irritation of the joint and limitation of motion reduces the frequency of motion of the biceps tendon in its sheath. The result is that the tendon

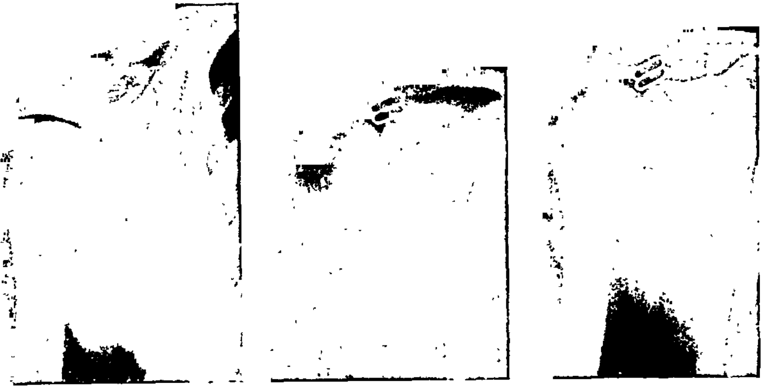

Fig. 6.—Effect of contraction of long head of biceps on descent of humeral head. *Left,* resting position. *Center,* descent of the humeral head by 15 pounds of traction with biceps relaxed. Traction is applied only to arm, and forearm is resting in supinated and flexed position. *Right,* descent of humeral head by traction of 15 pounds plus active contraction of biceps. Weight is supported directly on forearm. Note that added effect of muscular contraction promotes maximal displacement.

becomes adherent to the surrounding bony structure. It is not necessary for an inflammatory process to cause adherence of the tendon within its sheath. This is amply proved by the hand in which after severance of a tendon, the distal segment of the tendon becomes adherent throughout its canal, even in the absence of an inflammatory process. It seems to be a result of inactivity rather than of inflammation. Nature incorporates the nongliding tendon into the surrounding structures. No one structure, when adherent, can be condemned as an isolated cause of restriction of joint motion. Rather, it is a combination of all structures within the joint that have become mutually adherent because of the inflammatory process. The musculature too assumes adaptive shortening or stretching.

Nor can the origin of the pain be definitely determined. Lippman and DePalma theorized that the constant traction of adhesions about the bicipital tendon is the cause of pain. It seems more logical to assume that the site of greatest congestion and destruction, namely, the soft tissues pinched in the acromiohumeral interval, is the site of these discomforts. Direct compression of the bicipital tendon is another possibility. An excellent example of deep tendon pain is that associated with the achilles tendon. To add to the confusion, it has been my experience on a number of occasions to explore a shoulder and then, without doing anything definitive, to close the joint, only to discover postoperatively that the patient's pain has been surprisingly relieved. The mechanism remains obscure. Lippman stated that the subsidence of pain is coincident with the fixation of the biceps tendon in its groove. He therefore pointed an accusing finger at the biceps tendon adhesions. However, the intra-articular portions of the tendon at the same time become thinned or obliterated, so that the tendon is no longer subject to compression and therefore lacking in sensitivity. Doubts may be raised against the possibility of a trigger area. The frequent association of a frozen shoulder with a similarly frozen hand and the alleviation of pain by sympatheticolytic drugs or sympathectomy strongly suggest a factor associated with the central nervous system. Injury to the hand resulting in freezing of the proximal part of the extremity occurs too often to be regarded as a coincidental injury. The neurovascular contribution to frozen shoulder requires investigation.

*Examination.*—A thorough examination of the shoulder, with attention directed to the following points, is a prerequisite to determining the type of treatment to be given. The first point of tenderness is above the greater tuberosity and just adjacent to it. When the trouble is limited to this region, the patient may shrug the shoulder on attempting abduction and point to this spot as the site of discomfort. Alternately, at the same examination, the shoulder movement may be performed freely, without any discomfort whatsoever. This is indisputable evidence that the disturbance in the mechanism of abduction is a factor in producing or exciting the reaction around the cuff of the humeral head. Whether the disturbance of the mechanism is primary or is secondary to a lesion or an inflammatory process in the cuff at this region remains to be studied. When the condition is slightly more advanced, tenderness is demonstrable along the bicipital groove. The various tendon signs described by other authors, including that of Yergason, may be demonstrable.

Active abduction and forward flexion are next tested. Both of these motions are done, first with the arm in internal and next in external rotation. The rotation of the humeral head may bring the tender lesion around to the point of greatest compression and will bring out the discomfort and shrugging mechanism that might not be demonstrable in other phases of the arc of rotation. Passive motion is next tested and compared with active motion. As a general rule, in the late stages of frozen shoulder, the passive motion does not differ greatly from the active. This is in contrast with the condition observed in the early, nonadhesive stage, in which the passive motion greatly exceeds the active and may even possess a full range.

Next, a local anesthetic is injected into the tender area to remove the possibility that pain will restrict the range because of the setting up of muscle spasm, and the ranges of active and passive motion are once again determined. If a full range of active motion is obtained, the condition may be considered in a very early stage and without adhesions. If, on the other hand, restriction is marked, and is comparable to the range observed before anesthetization, the presence of adhesions and classification of the lesion as a late one are definite. If good abduction is obtained actively, attempts to maintain the position against resistance may demonstrate that the arm is weak and may drop to the side. This strongly suggests that the maintenance and fixation of the head in the glenoid is not obtainable because of interruption of the musculotendinous cuff.

Roentgen films are taken. In the typical frozen shoulder the humeral head is very high in the glenoid and the upper edge of the head is superimposed upon the acromion. If downward traction is exerted on the extremity, or if the biceps flexion is strong and exerted against resistance, the humeral head should normally descend and the humero-acromial space should widen. Failure to demonstrate a difference from the previous film indicates that the capsule is markedly contracted and adhesions and fixation are extreme. The greater tuberosity may demonstrate reduction in size (recession), and there may be

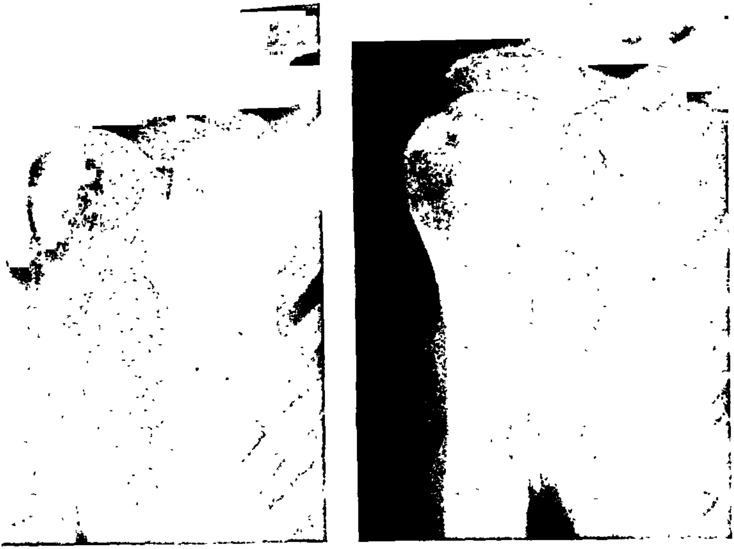

Fig. 7.—Failure of descent of humeral head in contracted stage of frozen shoulder. *Left,* resting position. *Right,* 15 pounds of traction applied with biceps actively contracting. Descent is minimal. Note irregular sclerotic recessional changes about greater tuberosity.

sclerotic and irregular changes at the point of attachment of the cuff. This indicates long-continued friction and irritation of the area. The area just proximal to this tuberosity is the trigger point that sets up the vicious cycle. These observations about the tuberosity are obtainable in practically all cases of frozen shoulder. They are pathognomonic of long-continued compression and irritation where the tuberosity comes in contact with the acromion.

*Treatment.*—Conservative treatment is the *modus operandi* in all cases. The patient is placed in absolute bed rest with the arm hanging in a dependent position, or traction is exerted distally to eliminate the humero-acromial compression. A few patients gain a great deal of comfort by placing the arm in wide abduction, so that the tuberosity has passed beyond the acromion and lies medially in an area of relatively little compression. This is effective only in the early stages. Ice packs are applied for prolonged periods for their anesthetic effect and for the reduction of congestion. Sedatives are given until the pain subsides completely. Almost complete elimination of discomfort may take from one to six weeks. This is followed by exercises designed to strengthen the biceps muscle without permitting abduction. The increased tonicity of the biceps muscle theoretically is effective in creating a depressor effect on the humeral head. Pendulum exercises, to stretch the capsule and create enough redundancy inferiorly to permit downward descent of the head during abduction are started. Next, graded active and passive abduction exercises are instituted. The adductors are stretched. The arm is maintained in neutral rotation. After over 90 degrees of abduction is obtained, external and internal rotation stretching and exercises are done. By directing the patient to use a bath towel in the same manner as in drying the back after a bath, one has an effective means of combining active and passive exercises in internal and external rotation at home. The patient is also instructed to attach a pulley very high on a door and by means of a clothesline, which is held by the ends, alternately to raise and lower the affected extremity. This is an effective passive exercise to increase the range of motion in the shoulder and to stretch the inferior capsule and the adductor muscles. Wall-climbing exercises are also done.

The indications for arthrotomy are quite definite. They are (1) failure to respond to conservative treatment as regards both motion and pain; (2) too slow an improvement, economically undesirable; (3) recurrence, and (4) suspected gross damage to the cuff, tendon and bony structures.

The operation is performed as follows: An incision is made that permits adequate exposure. I use the Cubbins incision, which severs the deltoid at its fibrous origin from the acromion and affords further exposure in the deltopectoral interval. The acromion is exposed subperiosteally and is removed immediately lateral to the acromioclavicular joint, to insure preservation of the joint and at the same time permit an adequate removal of bone. I regard this step as the most important in restoration of full motion in the shoulder. Next, the bursa is removed. This tissue may be reddened, thickened, and full of adhesions which may obliterate its cavity. At the floor of the bursa one inspects for tears in the cuff. Any abnormality of the biceps tendon is determined. An incision is made through the transverse humeral ligament, extending longitudinally through the cuff so that the incision partially includes the coracohumeral ligament on a bias. This exposes the interior of the joint. The intra-articular segment of the long tendon of the biceps is removed. The distal portion of the tendon is removed from the groove, transfixed with braided silk ligatures, and held with a hemostat. A flap of bone is elevated from the groove, remaining attached at one side; the distal tendon is laid beneath it, and the flap is laid over the tendon. The silk sutures are brought through a drill hole in the proximal portion of the humerus, thereby insuring its fixation. A good portion of the coracoacromial ligament is resected. While under direct exposure, the humeral head is gently manipulated so as to release very fine adhesions that may be present within the joint cavity. Forceful manipulation is avoided. Cutting the inferior capsule is optional and probably unnecessary, because it will stretch with suitable postoperative care. The capsule incision and the cuff defects are repaired with black silk. The deltoid is restored by approximation of the proximal border to the reflected acromial tissues. Postoperatively the extremity is placed on an abduction frame or in a sling. In my experience, neither the return of deltoid function nor the subsequent course has been aided by the abduction position. Very early biceps and pendulum exercises are instituted. This is followed by a course of treatment similar to that outlined in the preceding section.

*Standardization of Results.*—The words "satisfactory" and "good" are not to be used in evaluating final results. What might be considered satisfactory by one surgeon may not be a good result to another. A normal shoulder has a definite full range of abduction, adduction, external and internal rotation, and forward and backward flexion. It is strong and resistant to definite opposition to movement. It is devoid of pain. I suggest that all these factors be recorded in evaluating the final result of a treatment. In recognizing the value of a form of treatment, one should take into account the length of time necessary to achieve the desired results. It is foolhardy to use a treatment that requires three or four years to obtain a normally functioning shoulder when another form of treatment results, within a few months, in a shoulder slightly less functional but useful. The economic factor is a definite consideration in all but exceptional cases.

### SUMMARY

1. The pathogenesis of frozen shoulder is postulated on the basis of previous anatomic and pathologic observations.
2. Conservative treatment is recommended in all cases.
3. Operation is recommended in exceptional cases after definite indications have appeared, such as failure to respond to conservative treatment, economic reasons, recurrences, and suspected intraarticular lesions necessitating repair.
4. A standard for classifying the final results of the various forms of treatment is suggested.

### RÉSUMÉ

1. Pathogénie de l'ankylose de l'épqule basée sur l'anamnèse (anatomie et pathologie).
2. L'auteur recommande un traitement conservateur dans tous les cas.
3. L'opération n'est indiquée que dans les cas suivants: échec du traitement conservateur, raisons économiques, récidives, lésions intra-articulaires.
4. Basé sur les résultats finaux des différentes méthodes de traitement, l'auteur propose une classification.

### ZUSAMMENFASSUNG

1. Die Pathogenese der steifen Schulter wird auf Grund früherer anatomischer und pathologischer Beobachtungen dargestellt.
2. Für alle Fälle wird konservative Behandlung empfohlen.
3. Ein operativer Eingriff ist nur in Ausnahmefällen empfehlenswert, wo ganz bestimmte Indikationen, wie das Versagen konservativer Massnahmen, wirtschaftliche Verhältnisse, Rückfälle und Verdacht auf Gelenkverletzungen eine chirurgische Wiederherstellung erfordern.
4. Es wird ein Plan zur Klassifizierung der Endergebnisse der verschiedenen Behandlungsmassnahmen vorgeschlagen.

### RESUMEN

1. Se postula la patogénesis del hombro congelado sobre la base de observaciones anatómicas y patológicas previas.
2. Se recomienda el tratamiento conservador en todos los casos.
3. Se recomienda la operación en casos excepcionales después de que hayan aparecido indicaciones definidas, tales como fracaso del tratamiento conservador, razones económicas, recidivas, y lesiones intraarticulares sospechosas que requieren reparación.
4. Se sugiere un tipo para clasificar los resultados finales de las diversas formas de tratamiento.

### RIASSUNTO

1. Viene tracciata la patogenesi della rigidità di spalla sulla base di osservazioni anatomo-patologiche.

2. In ogni caso la cura è conservativa.
3. Eccezionalmente è indicato un intervento chirurgico, e solo quando ogni altra terapia è stata inefficace, o per ragioni economiche, o per recidiva o per la correzione di lesioni intraarticolari.
4. Viene proposto uno schema per inquadrare i risultati di ogni tipo di cura.

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Individualism in the sense of isolation is merely a spatial illusion. The more self-sufficient an individual seems to be, the more sure it is that, like Thoreau at Walden Pond, he carries a whole society in his bosom. This fact applies equally to nations. Both physically and spiritually we are members one of another; and we have never been anything else, although the callosities of ignorance and egotism have sometimes made us insensitive to this condition. This sense of cosmic interdependence is both one's ultimate intuition about the universe, and the most direct key to its practical activities: for the cosmic sense probably grew originally out of the realities of social life itself, the oneness of the tribe, of parent and child, of husband and wife. Without this sense, man is a defiant atom, awaiting annihilation—a cruel joke in a mirthless world.

—*Mumford*

# Allergenic Tissue Reaction of Catgut, an Aid for the Obliteration of Varicose Veins

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CATGUT produces an appreciable inflammatory allergic tissue reaction. This is in contradistinction to the effects of nonabsorbable material like silk, nylon, cotton, steel, vitalium and others, which are tolerated by the tissue with little or no reaction, owing to their lack of intrinsic allergens.

For some unknown reason the allergic catgut reaction is more pronounced the more superficially the suture is placed; i.e., in deep subcutaneous, subfascial and muscular layers, or in the serosa, the reaction is not as severe as it is just beneath the derma.

This property of catgut can be utilized for obliteration of varicosities in conjunction with either more radical surgical measures or with sclerotherapy, as the case requires. The allergic reaction is mild and self-limited. Generalization does not occur.

The catgut periphlebitis reaches about ½ inch (1.2 cm.) above and below the ligation level. The segments between occluded sectors usually obliterate secondarily.

In 1947 I described a special ligation knife that facilitated percutaneous ligation of varicose veins.[1] Recently I have been using a three-eighth curved needle with a cutting edge instead of a point (Fig. 1).

With a No. 11 Bard-Parker blade, a stab incision is made at each side of the visible or palpable varix. The needle, threaded with No. 0 catgut, is then introduced through one opening and carried between the skin and the vein. It emerges through the opposite stab wound. The catgut lies between the skin and the vein. The needle is then reinserted through the second opening and carried underneath the vein, and emerges through the first incision. Both catgut limbs embrace the vein and are tied with a square knot. The short ends are tucked underneath the skin. No sutures are necessary. A reversed technic is sketched in Figure 2.

Regular cutting needles are not practical, because they are apt to pierce the vein wall and the skin with their sharp points. Even with the recommended needle, injuries to the vein wall occur in about 10 per cent of the cases. The subsequent bleeding can be controlled either by adjacent subcutaneous ligations or by leg elevation and compression alone. When

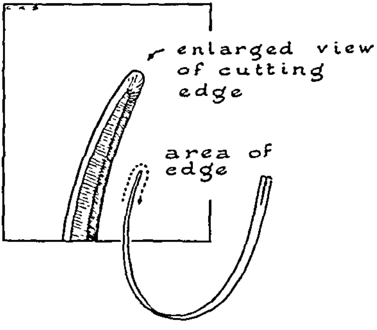

Fig. 1.—Ligation needle.

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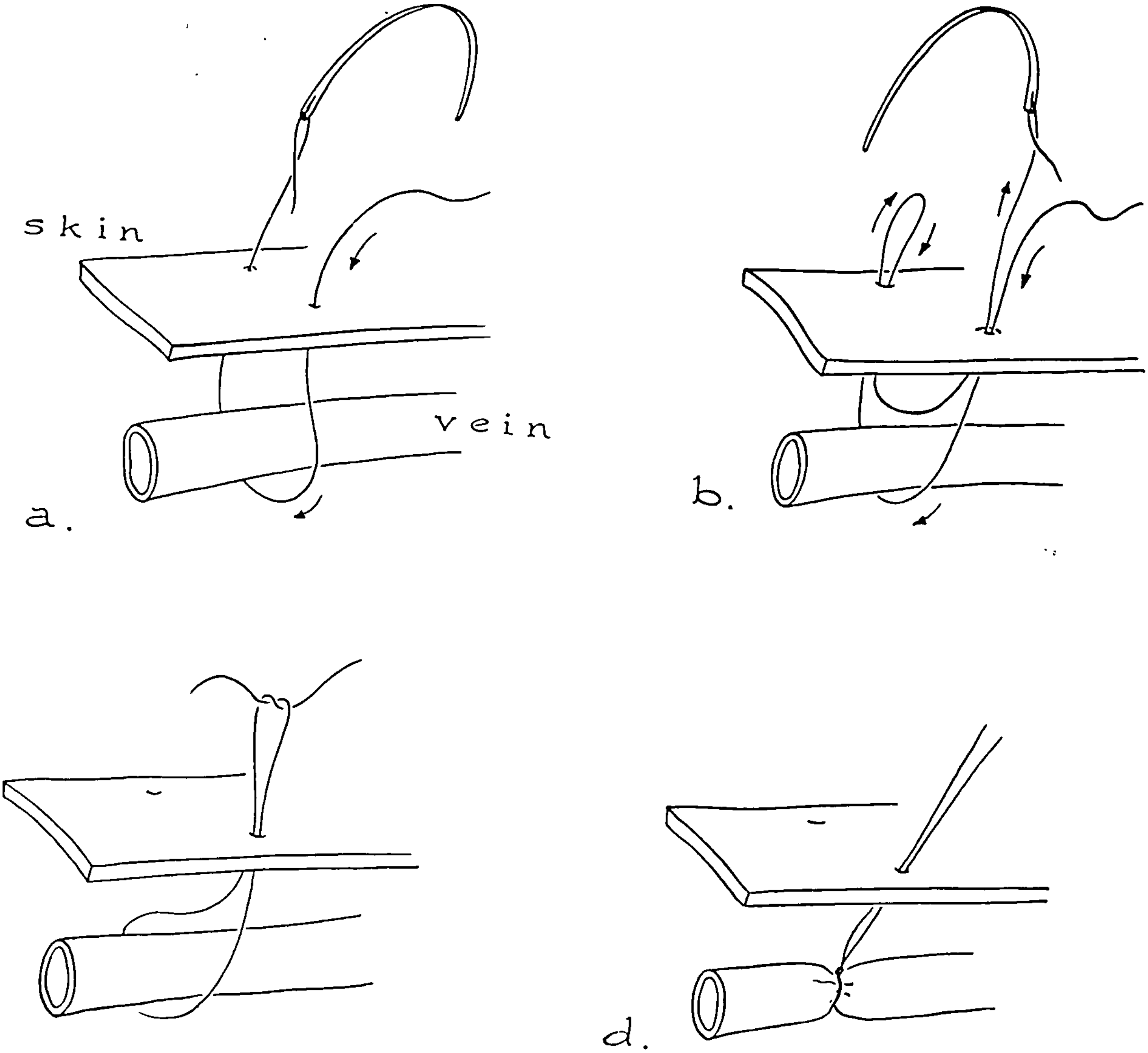

Fig. 2.—Percutaneous ligation of varicose veins with a special ligation needle and No. 0 catgut.

only part of the vein wall is included in the ligature, the postoperative periphlebitis will produce satisfactory obliteration of the treated vein sector.

During the next few days the skin at the ligation sites becomes slightly edematous and red (Fig. 3). The postoperative discomfort is mild if an adequate compression bandage is applied. This reaction is desirable and of therapeutic value. The catgut ligature produces not only chemical phlebitis but thrombus formation mechanically due to injury of the intima plus blood stagnation.

The therapeutic catgut phlebitis subsides after three or four weeks. The patient must be told that this will occur. The number of subcutaneous ligations is optional. I have made up to fifteen at one session. Ligations can be undertaken with the region under local anesthesia.

The use of catgut ligatures is not recommended exclusively as a method of obliterating veins. It is an auxiliary procedure. If possible, the varicosed saphenous vein should be stripped. If there are tortuous, superficial veins that cannot be stripped, and if the blowout veins have been ligated subfascially, subcutaneous ligation of the varices with catgut is an expedient and effective method. It leaves practically no scars. There is no need to do multiple ligations through fifteen and twenty incisions, as is still recommended.

Patients who refuse operation may be benefited by subcutaneous ligation plus sclerotherapy. Large amounts of sclerosing agents are dangerous and must be avoided. Multiple subcutaneous catgut sutures permit the use of minute doses of sclerosing agents.

I employ a 3 per cent solution of sodium tetradecylsulfate (Sotradecol®), and rarely exceed 0.2 cc. If the foam of this solution is used, the thrombogenic activity is four times as strong as that of the solution itself.[2] Small amounts of air injected into varicosities of the lower extremities are completely innocuous.[2]

Postoperative thrombi originating after ligations and injections must be evacuated after three to five days.[3] Not only are these thrombi painful, but they form the basis for recanalization. If the venous channel cannot be extirpated, occlusion of the vein should be attained by intima concretion and not by thrombus organization.[2]

After both ligations and injections, compression bandages must be applied to assure approximation of the intima. It is advisable to give penicillin systematically and to add it to the procaine hydrochloride solution.

## SUMMARY

A percutaneous catgut ligature around the varix produces chemical periphlebitis leading to venous obliteration. A special needle to perform this ligature is recommended.

Percutaneous ligations are auxiliary measures in the eradication of varicosities. They are useful when stripping is not feasible. Since the veins are broken up into smaller sections, a tremendous reduction of sclerosing agents is achieved, making sclerotherapy safe.

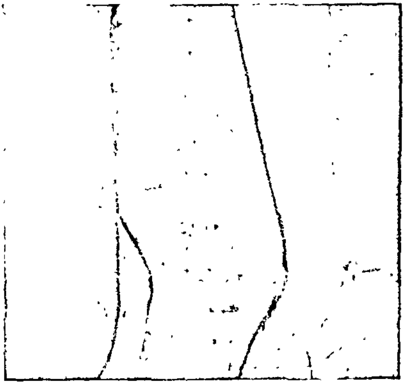

Fig. 3.—Status five days post operationem. Note the "therapeutic" allergic dermal reaction at the sites of ligation.

## RIASSUNTO

La legatura percutanea delle varici con catgut produce una periflebite chimica che porta all'obliterazione venosa. Viene raccomandato uno speciale ago, particolarmente adatto per praticare yale legatura. Le legature percutanee costituiscono, nella cura delle varici, un mezzo terapeutico sussidiario; specialmente utili riescono poi quando la cura radicale non può essere praticata. Dato che le legature frazionano le vene in segmenti brevi, la quantità delle sostanze sclerosanti viene assai ridotta, il che rende assai più sicuro tale mezzo terapeutico.

## SUMARIO

Uma ligadura percutânea com catgut em tôrno da veia varicosa produz uma perifeblite, acarretando a obliteração venosa. Uma agulha especial para realizar esta ligadura é recomendada.

Ligaduras percutâneas são medidas auxiliares na cura das varicosidades. Elas

são úteis quando a extirpação não é factível. Desde que as veias sejam interrompidas em pequenos setores, consegue-se a escleroterapia com uma quantidade muito menor de agentes esclerosantes.

### RÉSUMÉ

La ligature percutanée au catgut autour d'une varice provoque une périphlébite chimique avec oblitération veineuse. Une aiguille spéciale est recommandée pour cette ligature.

Les ligatures percutanées sont des mesures auxiliaires dans l'éradication de varicosités. Elles sont utiles lorsque l'on ne peut opérer. Etant donné que les varices se divisent en plusieurs bourrelets séparés, la sclérose se fait plus facilement et la sclérothérapie devient ainsi sans danger.

### RESUMEN

Una ligadura percutánea con catgut al rededor de la várice produce una periflebitis química con obliteración venosa. Se recomienda una aguja especial para llevar a cabo esta ligadura.

Las ligaduras percutáneas son medidas auxiliares en la erradicación de las várices; siendo útiles cuando el desgarramiento venoso no es practicable. Ya que las venas son divididas en pequeñas secciones, se logra una reducción notable de agentes esclerosantes, haciéndose una escleroterapia inocua.

### ZUSAMMENFASSUNG

Das Anlegen einer perkutanen Catgutunterbindung um einen Krampfaderknoten herum ruft eine chemische Periphlebitis, die zur Verödung der Vene führt, hervor. Es wird eine besondere Nadel zur Ausführung solcher Ligaturen empfohlen.

Perkutane Unterbindungen sind Hilfsmittel zur völligen Beseitigung von Krampfadern und erweisen such als nützlich, wenn das Herausziehen der Adern nicht durchführbar ist. Dadurch dass die Venen in kleinere Abschnitte unterteilt werden, lässt sich eine gewaltige Ersparnis an sklerosierenden Mitteln erzielen, was zur Sicherheit der Verödungstherapie beiträgt.

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> Life is the art of drawing sufficient conclusions from insufficient premises.
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> —*Smith*

# Carcinoma of the Penis

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CANCER of the penis constitutes 1 to 3 per cent of all carcinomas in the male. In my series of cases it has occurred with equal frequency in the white and in the negro race.

With regard to age incidence, penile carcinoma in most cases occurs between the ages of 40 and 70. My series of 52 cases included 2 under the age of 30. The average age for the entire group was 54.5 years.

There seems to be general agreement that penile cancer is associated with the presence of the foreskin. Chronic irritation is present when the prepuce is difficult or impossible to retract. Inspissated smegma irritates the glans penis and foreskin and gives rise to prolonged irritation, which is the most serious predisposing cause. Lewis has pointed out that a retractable foreskin does not insure against the retention of smegma. Nineteen of his 70 patients with penile cancer had retractable foreskins without phimosis. Circumcision in early life apparently does give relative protection. Circumcision in later years, however, has little prophylactic value. Jews practically never suffer from carcinoma of the penis, and the condition is rare among Mohammedans, who practice circumcision between the third and tenth years of life.

Syphilis and chancroidal lesions have been mentioned as possible causes of cancer of the penis but there is no definite proof of this. It is true that the incidence of venereal disease in cases of cancer of the penis is higher than that in the general population.

There are two types of carcinoma of the penis: the flat, infiltrating type and the papillary type, which frequently becomes a fungating or cauliflower growth. Histologically, both are squamous cell carcinomas. Either may proliferate externally and may also be invasive so that clinical differentiation is difficult.

The flat infiltrating type of tumor frequently starts as an ulcer that infiltrates and excavates deeply beyond the margins of the ulcer. Its extension into the corpus cavernosum is delayed by Buck's fascia. The urethra and the corpus spongiosum are rarely if ever involved. The commonest sites of this tumor are the glans, the prepuce, the coronal sulcus, the frenum and occasionally the body of the penis.

The papillary type of tumor may begin as an apparently benign papilloma or small wart. Such growths commonly appear on the glans or on the mucosa of the prepuce. They increase in size and number, frequently become infected and when examined present a papillary, fungating, cauliflower-like, foul-smelling mass.

Metastasis in penile cancer occurs relatively late as compared to its appearance in other malignant diseases. It takes place by embolism or migration of groups of malignant cells through lymphatic channels to the regional nodes. Metastatic spread takes place by the lymphatics to the inguinal and femoral group of glands. Later the iliac and periaortic groups of glands are invaded. Blood-borne metastases are rare. There was 1 case of pulmonary metastasis in my series. A point should be made here of the fact that enlarged [illegible] glands do not mean meta-

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static involvement. The enlargement of lymph glands in many cases is due to inflammatory changes from secondary infection of the penile lesion; also, many glands that do not appear enlarged will show involvement in cancer.

The diagnosis of cancer of the penis is made by biopsy. All suspicious lesions of the glans penis and foreskin call for a biopsy. Granuloma inguinale, condyloma acuminata, syphilis, tuberculosis, and papillomatosis of the penis are all occasionally mistaken for carcinoma. Chancroids are painful and often grow quite rapidly. If the ulcers do not heal quickly under treatment, a biopsy is indicated in every case. Many of the cases with penile carcinoma whom I have seen have been treated extensively elsewhere with courses of penicillin or other therapy.

The question of whether metastases are present is often difficult to answer. It is known that hard, shotty glands or glands fixed to the surrounding tissues are characteristic of malignant change. Most of my patients had palpable inguinal nodes, but biopsy of the nodes gave negative results for cancer cells in 29 of the 53 cases. Biopsy of inguinal lymph nodes is often misleading and probably should not be relied upon.

Many types of treatment have been used in the management of cancer of the penis. The lesion is usually radioresistant, and very heavy doses of radium and roentgen rays are required for their removal. Lesions measuring 2 cm., or less have been treated successfully with radium. Radium, however, should not be used if the corpora are involved.

Surgical removal is generally accepted as the best means of curing cancer of the penis. The surgeon has the choice of performing (1) partial amputation, with or without lymph gland dissection, or (2) radical amputation, with or without lymph gland dissection and with or without the inclusion of total emasculation.

A great diversity of opinion exists with regard to the proper treatment of the lymph nodes. Dodson stated that there is a great advantage in performing a complete block dissection, removing the inguinal and femoral nodes in one mass with the penile cancer, when the age and physical condition of the patient permit. Colby and Smith advised groin dissection in all cases except those in which the lesion is in the earliest stages. With this I thoroughly agree, and it is the procedure that I follow in my cases.

When radical operation is indicated, I have usually done the operation in two stages. The amputation of the penis done at the first stage. The chief cause of death following groin dissection is infection. If the gland dissection is delayed one or two weeks after amputation, the infection usually subsides. Then the gland dissection can be done more easily, and the mortality rate is decreased. In the last three radical operations I have done, I have followed the technic recommended by Hudson, Hopkins and Fish, which seems to me to offer a greater possibility of cure than do the other procedures available.

In my series of 52 cases, I performed partial amputation without groin dissection in 12. In 9 cases I used partial amputation with bilateral groin dissection. In 25 cases I did radical amputation with bilateral groin dissection, including, in the last 3 cases, dissection of the deep iliac and preaortic nodes.

Of this group, at the time of writing, 8 have died of carcinoma of the penis or metastases. Thirteen have died of other causes, a few of whom may have died of carcinoma. Twenty-nine are living without recurrence or metastases. Four are living with recurrence of metastases.

### SUMMARY AND CONCLUSIONS

1. A clinical study of 52 cases of car-

cinoma of the penis is presented, with a short review of the subject.

2. The young as well as the old may suffer from carcinoma of the penis.

3. Phimosis, with subsequent irritation of the glan penis and foreskin, seems to be the predisposing cause of penile cancer.

4. Circumcision in infancy or early childhood apparently is a protection against carcinoma of the penis.

5. All suspicious lesions of the penis should have been examined by biopsy.

6. Surgical intervention offers the greatest chance of cure of cancer of the penis, and radical operation, in the author's opinion, offers the greatest possibility.

### RESUMEN Y CONCLUSIONES

1. Se presenta un estudio clínico de 52 casos de carcinoma del pene, con una revisión sobre el tema.

2. Tanto los jóvenes como los viejos pueden sufrir de carcinoma del pene.

3. La fimosis, con la consiguiente irritación del glande y el prepucio, parece ser la causa predisponente del cáncer del pene.

4. La circunción en la infancia parece ser una protección contra el carcinoma del pene.

5. Todas las lesiones sospechosas del pene deben ser examinadas por biopsia.

6. La intervención quirúrgica ofrece las mayores probabilidades de cura del cáncer del pene, en la opinión del autor la cirugía radical ofrece la mayor posibilidad.

### CONCLUSIONI RIASSUNTIVE

1. Breve rassegna dell'argomento e studio clinico di 52 casi di carcinoma del pene.

2. L'affezione è comune nei giovani come negli adulti.

3. Nei vecchi la causa predisponente sembra essere la fimosi e la conseguente irritazione del glande e del prepuzio.

4. La circoncisione nella prima età può rappresentare una protezione nei confronti del cancro del pene.

5. Tutte le lesioni sospette devono essere esaminate biopticamente.

6. L'intervento chirurgico radicale consente le maggiori possibilità di guarigione.

### RÉSUMÉ

1. Etude clinique de 52 cas.

2. Le cancer du pénis s'observe à tout âge.

3. Le phimosis, avec irritation consécutive du gland du pénis et du prépuce, paraît être la cause prédisposante de cette affection.

4. La circoncision dès la première enfance paraît constituer une protection contre ce cancer.

5. Une biopsie devrait être pratiquée dans tous les cas de lésion suspecte du pénis.

6. La thérapeutique qui offre le plus de chances de guérison est l'ablation totale du pénis.

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# The Surgical Implications of Ductus Arteriosus Patency in Cases of Fallot's Tetralogy and Corvisart's Complex

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THE objects of this case report are (1) to direct attention to a clinically diagnosable form of Fallot's tetralogy or Corvisart's complex, associated with persistent patency of the ductus arteriosus, and (2) to consider the question of surgical intervention in cases of this type.

Fallot's tetralogy is a well-defined clinicopathologic entity comprised of four basic lesions: stenosis or atresia of the pulmonary artery, an interventricular septal defect, dextroposition of the aorta, and hypertrophy of the right ventricle. First reported by Sandifort, in 1777, this condition had attracted the attention of several independent observers prior to the classical studies of Fallot (1888). The association of the tetralogy with a right-sided aortic arch, first described in 1814 by Corvisart, long before Fallot's time, has been frequently referred to in the literature as Corvisart's complex or Corvisart's disease. Examples of the latter have been reported, from time to time, by numerous authors, including Peacock (1866), Assman (1928), Bedford (1929), Bedford and Parkinson (1936) and Lian and Marchal (1937). According to authoritative opinion (Taussig, 1947; Brown, 1950; Schnitker, 1952), the incidence of a right aortic arch, in cases of the tetralogy, is 20 to 25 per cent.

Recently, patients with Fallot's tetralogy and Corvisart's complex have been given a new lease on life by the development and successful application of surgical procedures such as those of Blalock and Taussig (1945), Potts, Smith and Gibson (1946), Holman (1949) and Brock (1952), with a view to establishing an adequate pulmonary blood flow. In the Blalock and Taussig operation this object is achieved by the creation of an artificial ductus arteriosus, usually by implanting the right subclavian artery into the right pulmonary artery, a procedure which has yielded excellent results in over 70 per cent of cases (Schnitker, 1952). The advantages of such an aorticopulmonary shunt in cases of the tetralogy are obvious for postoperative patients, for infants prior to obliteration of the ductus, and in the rare type of case, recently described, in which the ductus arteriosus remains patent (White, 1951). In the latter type of case, the patency of the ductus not only proves beneficial to the patient from the point of view of symptoms and signs (with the sole exception of the size of the heart which is usually larger) but does away with the need of any surgical intervention.

Although patency of the ductus arteriosus has been reported as associated with Fallot's tetralogy on several occasions, a

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similar phenomenon in the case of Corvisart's disease appears to have been reported only once (Dexter and associates, 1947). In view of the apparent rarity of the latter combination, the following case is considered worthy of publication.

## REPORT OF CASE

In M.F., a 10-year-old boy, a heart murmur was discovered at the age of 4 years. He had always been an active lad at school, indulging in various forms of exercise. On questioning, however, it was learned that he had always shown some tiredness or shortness of breath after physical effort. The dyspnea and fatigue had not been progressive. He had at no time displayed any tendency to syncopal attacks, convulsions, acute dyspnea, in the chest, edema or squatting. Slight blueness of the nails and lips had been noted since the age of 6 years. Apart from occasional attacks of cold and cough, the past history was normal.

On physical examination the boy appeared well developed and well nourished. The nails were bluish, but the lips were of normal color. There was a tendency to clubbing of the fingernails. The apical impulse was visible in the midclavicular line, in the fifth left interspace. A diastolic shock was palpable in the pulmonary area and a systolic thrill in the aortic area.

On auscultation, a loud and continuous "machinery" murmur, with systolic accentuation, was audible in the aortic area; it was maximal just below the right clavicle and was inaudible below the fourth rib on the right side and to the left of the sternum. A soft systolic murmur was heard over the left side of the precordium, with accentuation of the second heart sound. A faint systolic murmur was also audible over the neck vessels.

The neck veins were not engorged; the liver and spleen were not palpable, and edema was absent. The blood pressure in millimeters of mercury was 106 systolic and 84 diastolic. The boy weighed 60 pounds (27.2 Kg.) and was 4 feet and 6½ inches (138 cm.) in height. The blood count showed 5,400,000 red blood cells per cubic millimeter, with a 104 per cent hemoglobin.

Roentgen studies and fluoroscopic examination of the chest showed a "coeur-en-sabot" configuration of the cardiac silhouette (Fig. 1), with concavity of the left middle arc and a raised, blunt cardiac apex. The aortic knob was visualized on the right side (Fig. 1*A*) and showed increased pulsations. The hilar shadows were small. The left oblique view (Fig. 1*B*) showed marked enlargement of the right ventricle, with the convex bulging outline of the left ventricular border displaced upward and posteriorly. In the right oblique view the esophagus showed no appreciable aortic indentation or left auricular impression. The roentgen observations findings were regarded by the roentgenologist as diagnostic of Fallot's tetralogy.

The electrocardiographic record Fig. 2) showed most of the features characteristic of Fallot's tetralogy, viz., a gross degree of right axis deviation, pointed P waves of high amplitude in leads I, II, V1, V3 and V3R, Q waves in lead III, biphasic QRS complexes in lead I and a P-R duration of 0.2 second.

Since venous catheterization studies and angiocardiographic investigation were not permitted by the parents, the boy was discharged but kept under observation.

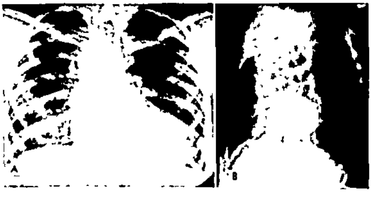

Fig. 1.—*A*, roentgenogram (anteroposterior view) showing the "coeur en sabot" configuration of the heart and the aortic knuckle on the right side. *B*, roentgenogram (left oblique view) showing marked enlargement of the right ventricle and displacement, upward and posteriorly, of the left ventricular border.

## COMMENT

In view of clinical, fluoroscopic and electrocardiographic features typical of the tetralogy of Fallot in conjunction with a right aortic arch, a diagnosis of Corvisart's complex or Corvisart's disease appeared certain.

The typical loud, continuous machinery murmur in the aortic area, as described previously in the literature (Dexter and associates, 1947; White, 1951), furnished evidence of a persistent patent ductus ar-

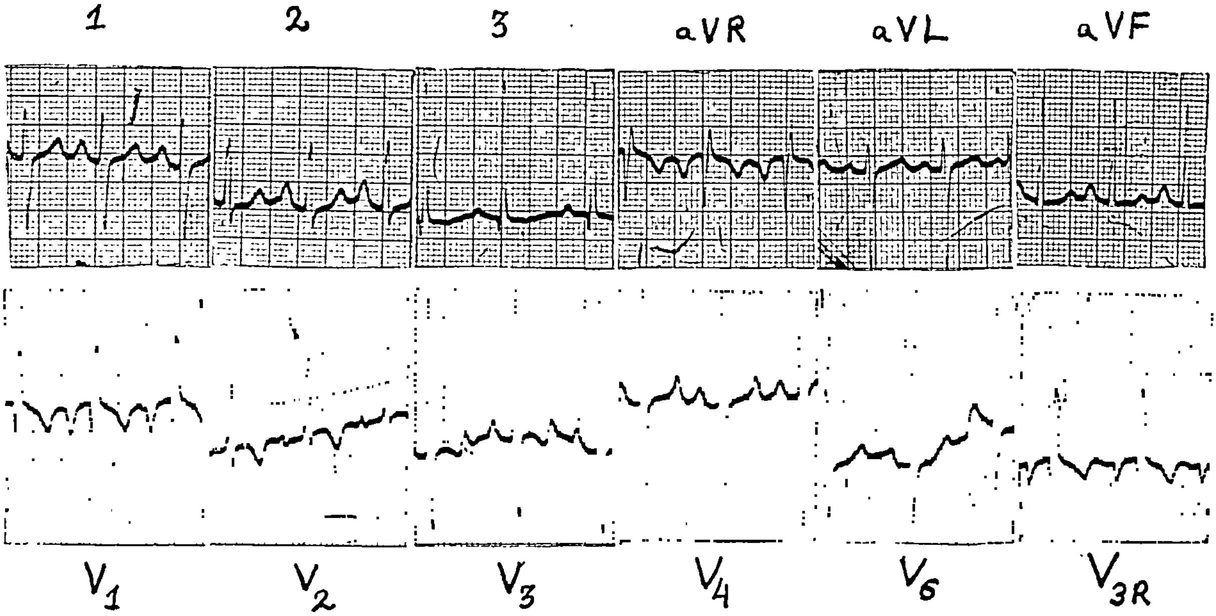

Fig. 2.—Electrocardiogram showing marked right axis deviation, spiky P waves in Leads I, II, V1, V3 and V3R, a biphasic QRS in Lead I, and a P-R duration of 0.2 second.

teriosus. As has been shown previously, in cases of Corvisart's complex the ductus arteriosus may conform to one of the two forms; it may either run between the right pulmonary artery and the aortic arch or from the left pulmonary artery to the left subclavian or left-sided innominate artery (Edwards, 1953; Blalock and Bahnson, 1948). The unusual site of the machinery murmur, in the aortic area, as reported by Dexter and his associates in their Case 3 (1947) and in the present case, suggests patency of the former variety of ductus, i.e., between the right pulmonary artery and the aortic arch.

On the basis of existing data, the following clinical features may be regarded as evidence of patency of the ductus in an otherwise typical case of Fallot's tetralogy or Corvisart's complex; 1. *The presence of a loud and continuous "machinery" or "humming top" murmur in either of the basal auscaltatory areas of the heart.* The murmur usually shows a systolic accentuation, is accompanied by a thrill and may be localized or diffuse; in the latter case it may be heard all over the precordium and the back. Its localization has diagnostic value; while in cases of Fallot's tetralogy it is maximal in the pulmonary area, in Corvisart's complex its maximal intensity may be either in the aortic or the pulmonary area, depending on the site of the anomalous ductus. In Dexter's case as well as in mine, the maximal intensity of the murmur was noted in the aortic area, although diffusely heard in the former case and localized in the latter. 2. *An attenuation of the usual symptoms and signs of Fallot's tetralogy.* This is due to a natural correction of the physiologic defect by the patent ductus. Thus, the symptoms—exertional dyspnea, fatigue, diminished capacity for effort and a tendency to squatting—are much less marked or even absent. Similarly, cyanosis manifests itself, in a much milder form, as faint blueness of the nails or lips or both. Clubbing is minimal or absent. Features like polycythemia and hyperchromia of the blood are less marked. 3. *A moderate degree of cardiac enlargement, with preservation of the typical coeur-en-sabot configuration of the heart.* This offers a contrast to the uncomplicated tetralogy, in which the size of the heart is within normal limits. 4. *A better outlook or prognosis than is offered by the tetralogy pure and simple.* This is natural, considering that the pulmonary blood flow in the former case is far more satisfactory.

It is interesting to note that, from the points of view of both pathological physiology and clinical findings, the syndrome described here is closely similar if not identical to the postoperative case of the tetralogy i.e. after the creation of an artificial ductus or shunt. This is not strange, considering that the mode of correction of the defect is identical in the two cases, being a natural phenomenon in the former case and artificially induced in the latter. In either case, the inadequacy of the pulmonary blood flow is corrected by diversion of part of the blood from the aorta into the pulmonary circuit via the ductus or through the artificially improvised channel. The low incidence of this syndrome, as reported at present, is more apparent than real and due to lack of recognition or failure to report rather than to an actual infrequency of occurrence.

Quite apart from the academic interest inherent in the recognition of the syndrome as a distinct clinical entity, the subject deserves attention from the point of view of treatment. The coexistence of a patent ductus arteriosus in a case of Fallot's tetralogy or Corvisart's complex should be considered a contraindication to surgical intervention.

Although singly, either Fallot's tetralogy or a patent ductus arteriosus, is a suitable indication for surgery, an association of the two is a bar to surgical intervention.

### SUMMARY

1. A case is reported of Corvisart's complex (tetralogy of Fallot with a [illegible] aortic arch) associated with patency of the ductus arteriosus.

2. The clinical characteristics of the syndrome are defined, with a view to facilitating its recognition.

3. The undesirability of creating an artificial aorticopulmonary shunt by resort to surgical measures is stressed in the case of this syndrome.

### RESUMEN

1. Se comunica un caso de complejo de Corvisart (tetralogía de Fallot con arco aórtico derecho) asociado con persistencia de conducto arterioso.

2. Las características clínicas del síndrome se definen desde el punto de vista de facilitar su reconocimiento.

3. Se señala lo poco deseable de crear una derivación artificial aórticopulmonar recurriendo a las medidas quirúrgicas.

### RIASSUNTO

1. Viene descritto un caso di complesso di Corvisart (tetralogia di Fallot con arco aortico destro) associato a pervietà del dotto arterioso.

2. Vengono tracciate le caratteristiche cliniche dell'affezione e descritti i mezz per riconoscerla.

3. Viene segnaato come erroneo il provvedimento di creare, in tali casi, un'anastomosi aortico-polmonare.

### RÉSUMÉ

1. L'auteur rapporte un cas de complexe de Corvisart (tétralogie de Fallot avec crosse aortique droite) en relation avec une oblitération du canal artériel.

2. Les caractéristiques cliniques du syndrome sont mises en évidence, en vue de faciliter le diagnostic.

3. L'aut[illegible] souligne la nécessité d'éviter par des p[illegible] [illegible]irurgicaux la création

d'une anastomose aorto-pulmonaire.

## ZUSAMMENFASSUNG

1. Es wird über einen Fall von Corvisartschem Komplex (Fallotsche Tetralogie mit Rechtslagerung des Aortenbogens) bei gleichzeitigem offenen Ductus Botalli berichtet.

2. Die charakteristischen klinischen Erscheinungen des Krankheitsbildes werden beschrieben mit dem Ziel, ihre Erkennung zu erleichtern.

3. Es wird hervorgehoben, dass es in diesen Fällen nicht ratsam ist, durch chirurgische Massnahmen eine Verbindung zwischen Aorta und Lungenarterie zu schaffen.

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*Author's Correction:* Dr. Urban R. Finnerty, co-author with Dr. R. V. Gorsch of the article "Surgical Significance of the Anorectal Musculature," which appeared in the October issue of the *Journal,* requests us to announce that Figure 1, 3 and 4 were redrawn from Milligan and Morgan, "Surgical Anatomy of the Biliary Canal," Lancet, 1934-1937. This acknowledgment was inadvertently omitted in the preparation of the *Journal* manuscript.

# Tendon Transfer in Early Childhood

## The Importance of Anchorage Technic for Successful Results

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POLIOMYELITIS struck Israel severely in 1950 and to a lesser degree in the following years. The vast majority of its victims were children below the age of 3 years. Consequently, surgeons had to deal with many cases of feet with impaired muscle balance at an age when stabilization procedures were not applicable. As it is impossible to correct an unopposed muscle pull satisfactorily by any kind of orthopedic appliance, it was necessary in many cases to operate very early. The choice was between sacrificing the muscle by tenotomy or transferring its tendon to a place where its pull would improve the function of the foot instead of destroying its normal alignment. I could not accept the first possibility, as it meant further loss of living muscle tissue in a paralyzed leg; therefore, I began to transfer the tendons of the muscle in question in children from 2 to 6 years of age.

*Historical Notes.*—Since the first report on tendon transfer by Nicoladoni in 1881, many kinds of tendon transfers have been described and recommended. The enthusiasm for these well-founded operations was very often lessened by the great percentage of failures. In 1923 a commission was appointed by the American Orthopedic Association to examine the feasibility of these procedures. The commission pointed out that tendon transfers could give better

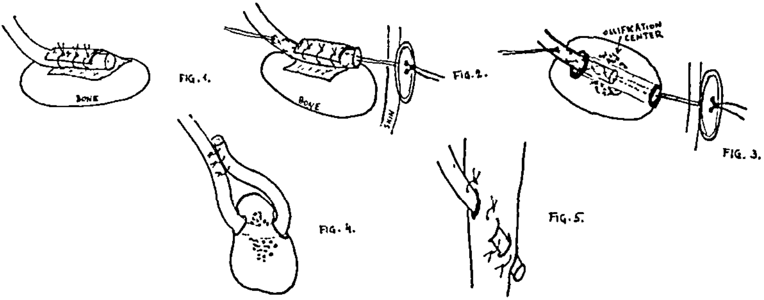

Fig. 1, silk suture to periosteum. Fig. 2, silk suture to periosteum [illegible] ll wire anchorage to skin. Fig. 3, Bunnell wire suture to skin after [illegible] pas[illegible] one canal. Fig. 4, suture of tendon to itself after passage [illegible] thro[illegible] slits in [illegible] rger [illegible]

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results only if used in combination with some kind of joint stabilization. This point of view reigns up to the present time at many clinics that have to deal with poliomyelitis.

If results in general were not so good, they were worse when the transfer was done in children below the age of 11. As recently as 1952 the following results were reported by Reidy, Broderich and Barr: 60 per cent of failures followed tendon transfers in the age group from 5 to 11 years, with only 30 per cent of failures in children over the age of 11. Kuhlmann and Bell, in the same year, stated the opinion that it is inadvisable to perform a tendon transfer in a child below the age of 5 years.

*Material for Study.*—To analyze the reasons for the bad prognosis of tendon transfers, the first series of 60 children below the age of 7 years was chosen. The distribution of age at which the operation was performed was as follows:

TABLE 1.—*Age at Operation*

| | |
|---|---|
| 2 years | 2 cases |
| 3 years | 14 cases |
| 4 years | 15 cases |
| 5 years | 16 cases |
| 6 years | 13 cases |

The average age was 4.4 years. The question posed was: Is there any reasonable chance for success in tendon transfers at that age? What conditions must be fulfilled to assure the functioning of the muscle after the operation? A tendon transfer in this series, therefore, had to be considered successful if the power of the transferred muscle remained reasonably good—at least Grade 3 according to the internationally accepted power grading. The power of the transferred muscles was tested first on the removal of plaster, six weeks after the operation, and then at regular intervals of four weeks. It was observed that a successful transfer generally functions immediately at the end of the immobilization period and gains in power during the following two to six months. In most cases the final power of the transfer, if successful, reached the original power of the muscle before the operation.

Failure of realignment in this series did not mean failure of the transfer, as long as the transfer could be felt and its function graded. In these cases faulty consideration or faulty power assessment must be blamed for the failure.

*Analysis of Operative Results.*—To assure normal alignment in imbalanced feet the following muscles were transferred:

TABLE 2.—*Muscles Transferred*

| *Muscle Transferred* | *New Insertion* | *No. of Cases* |
|---|---|---|
| Peroneus longus (Mayer-Biesalski method) | Cuneiform 1 | 25 |
| Extensor digitorum longus | Cuneiform 1 | 10 |
| Extensor hallucis longus or Tibialis anterior | Cuboid | 9 |
| Long flexors and peronei | Calcaneus | 7 |
| Long flexors and peronei | Achilles tendon | 5 |
| Others | Into bone | 4 |
| Number of transfers | | 60 |

In these 60 cases 14 failures were encountered, 11 of them in the first 25 operations. In reoperating on 4 of the 14 patients, the attachment of the tendon to its new insertion had been lost in 3, and in the fourth the tendon's end was attached to the periosteum which had been loosened and elongated by the pull of the muscle. The technic of the tendon suture was therefore changed, leading to better results. Table 3 shows the results of the transfers classified according to the attachment technic employed.

TABLE 3.—*Results*

| *Technic* | *No. of Cases* | *Failures* |
|---|---|---|
| Silk suture to periosteum (Fig. 1) | 24 | 12 |
| Silk suture to periosteum and Bunnell wire anchorage to skin (Fig. 2) | 11 | 2 |
| Bunnell wire suture to skin after passing tendon through bone canal (Fig. 3) | 14 | 0 |
| Suture of tendon to itself after passing bone canal (Fig. 4) | 6 | 0 |
| Tendon passed through slits in larger tendon, silk sutures (Fig. 5) | 5 | 0 |

## COMMENT

Tendons sutured to the periosteum of the small bones in children from 2 to 6 years of age often lose their attachment during the period of immobilization or immediately afterward. On the other hand, tendons that are passed through bone and securely fastened in this place almost always remain strongly attached to their new insertion. The explanation for the failures seems obvious: Periosteum from the tarsal bones, when exposed in a child of the age in question, exposes only cartilage, as the surface of these bones ossifies quite late. Exposed bone produces callus, which is a very good binding factor for an attached tendon, but no such tissue reaction is induced by exposing cartilage. Callus binds a tendon easily in a canal gouged through a tarsal bone, where the tendon passes through the bony center of the latter. Fibrous tissue reaction of a cut tendon also seems to be a good binding factor for tendon attachment, as no failure was encountered when a tendon was passed through slits of another tendon.

## SUMMARY

The technic employed in suturing tendons to a new point of insertion when performing a tendon transfer in children from 2 to 6 years of age is discussed. In 60 transfers 14 failures were encountered, all caused by physiologically unsound suturing of the tendon to its new area of insertion. When the right method is employed, a tendon transfer is a safe operation even for children at this early age.

## CONCLUSION

Tendon transfers are a safe procedure offering great probability of success even in children 2 to 6 years of age. Many failures are due to the fact that the new tendon is inserted in tissue that does not provide a firm attachment between tendon and bone. After a small-gauge cannula has been passed through the bone, the transferred tendon should be sutured to the skin by a pull-out wire suture according to Bunnell's technic. Other technics may be employed, provided they are conducive to strong union between the tendon and its new point of insertion.

## RÉSUMÉ

L'auteur discute la technique utilisée pour la suture de tendons à un nouveau point d'insertion lors de transfert de tendon chez des enfants de 2 à 6 ans. Sur 60 transferts de tendons, il y a eu 14 échecs, ayant tous pour cause une suture du tendon physiologiquement incompatible avec son nouveau point d'insertion. Lorsque l'on emploie la bonne méthode, un transfert de tendon est une opération sans risque, même chez des enfants en bas âge.

## SUMMARIO

A técnica da sutura de tendão à um novo ponto de inserção, quando se realiza o transplante de tendão em crianças de 2 a 6 anos de idade, é discutida. Em 60 transplantes, houve 14 insucessos provocados por sutura fi[illegible]gicamente imperfeita.

Quando o método é corretamente executado, o transplante de tendão é uma operação útil para a criança em qualquer idade.

## RESUMEN

Se discute la técnica empleada para suturar tendones en su nuevo punto de inserción; cuando se trata de su transferencia en niños de 2 a 6 años de edad. Se encontraron 14 fracasos en 60 transferencias, todos debidos fisiológicamente a la sutura no satisfactoria del tendón en su nueva área de inserción. Se considera que una transferencia de tendón es una operación segura, aún en niños de edad tan temprana, siempre y cuando sea empleado el método correcto.

## ZUSAMMENFASSUNG

Die Technik des Annähens einer Sehne an einen neuen Ansatzpunkt, wie sie bei Kindern im Alter von zwei bis sechs Jahren bei Sehnenverpflanzungen angewandt wird, wird erörtert. Bei 60 Verpflanzungen wurden 14 Versager beobachtet, die alle auf physiologisch falsches Annähen der Sehne an den neuen Ansatzpunkt zurückzuführen waren. Wenn die richtige Methode angewandt wird, ist die Sehnenverpflanzung sogar bei so jungen Kindern eine sichere operative Massnahme.

## RIASSUNTO

Viene discussa la tecnica impiegata nel suturare i tendini ai nuovi punti d'inserzione quando si esegue una trasposizione tendinea nei babini dai 2 ai 6 anni d'età. In 60 trasposizioni vi furono 14 insuccessi, dovuti all'impiego di metodi di sutura tendinea non corretti dal punto di vista funzionale, Se, viceversa, la sutura viene eseguita correttamente, la trasposizione tendinea dà ottimi risultati anche in bambini così piccoli.

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> To live is like to love—all reason is against it, and all healthy instinct for it.
>
> —*Smith*

# Surgical Treatment After Radical Cystectomy

## Report of a Case

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LONG-TERM survival of a patient after radical cystectomy and implantation of the ureters is uncommon. Metabolic balance is maintained by maximum action of protective mechanisms, and a thin reserve is left for additional physiologic burden. Further surgical intervention may start a train of irreversible damage. A case is reported of a patient who deterioriated rapidly after lumbar sympathectomy for peripheral vascular disease, performed six years after exirpation of the bladder.

### REPORT OF A CASE

A. M., aged 53, was admitted to the hospital on Nov. 12, 1953, complaining of weakness and showing dehydration. He had been operated on in 1947 for carcinoma of the bladder, with radical cystectomy and sigmoidal implantation of the ureters. On Sept. 10, 1953, he had undergone bilateral lumbar sympathectomy for intermittent claudication.

His convalescence was unsatisfactory. He complained first that his bowels moved less freely than before, and later of nausea and vomiting. He felt weak and listless, and also had pain in his legs.

The patient was small and pallid, and on examination looked old, toxic and dehydrated. The eyes showed arcus senilis, and the tongue was dry and brown. The heart and lungs were normal. The abdomen showed recent scars of bilateral lumbar sympathectomy and two old lower midline scars from earlier operations. The blood pressure in millimeters of mercury was 130 systolic and 80 diastolic.

He was treated with intravenous fluid and alkaline solutions by mouth. On November 16 the temperature rose to more than 102 F., and antibiotics were given for pyelonephritis. On November 17, roentgenograms showed dilatation of the left ureter and renal pelvis. A small amount of dye in the rectum at sixty minutes indicated poor renal function. The right side also showed moderate hydronephrosis. The patient responded to treatment, and he was discharged from the hospital on November 21.

He was readmitted on December 14, in coma. On the day of admission he had been apparently well, had been left alone for the day, and had lain down for a nap. A neighbor heard his loud sighing respiration and found that he could be roused only with difficulty.

Examination showed dehydration, pallor and coma. The skin was moist, the nose pinched and the tongue coated, dry and brown. venous pulsations were visible in the neck. The blood pressure in millimeters of mercury was 100 systolic and 60 diastolic. The carbon dioxide combining power was 30 volumes per cent, and the value for nonprotein nitrogen was 91 mg. Antibiotics and fluids were given. The patient improved and was up and about on December 19. The $CO_2$ combining power went to 66 volumes per cent and the NPN went to 40 mg. per cent. The chlorides were high. On December 23, 1953 he was able to go home.

On his last admission on January 3, 1954, he remained in coma and died on Jan. 5, of acidosis, uremia and renal failure.

### COMMENT

Experimental ureter implantation was accomplished in 1892,[1] and it was first tried on a patient in 1917. In 1927, experimental study of implantation at various levels showed that when it was made high in the small intestine the urine was totally reabsorbed. In 1940, Jewett reported that implantation in the descending

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colon permitted the reabsorption of some urinary constituents but not of creatinine.

In 1950, Ferris and Odel described the syndrome of hyperchloremic acidosis in patients with ureter-to-sigmoid implants. Reabsorption of chlorides and urea resulted in acidosis. Diarrhea also appeared in 55 per cent of patients with the syndrome. Although a copious current down the ureters plus a sensitive bowel response for emptying would defend against the syndrome, increased bowel activity alone did not afford protection.

Recent experiments[2] have shown that, with instillation of urine into the rectum, acidosis from reabsorption will not develop with a normal kidney if renal infection is absent. Surgical technic to develop a ureterointestinal junction by drawing the ureter out into the intestinal lumen has not resulted ideally. The free end in the lumen, diminished in blood supply and exposed to infection, sloughs and is replaced by granulation tissue. This is followed by stricture, obstruction, stasis and infection. A mucosa-to-mucosa anastomosis is followed by good healing but allows such communication with the urinary tract that changes in bowel pressure can be recorded in the pelvis of the kidney.

Kidney infection diminishes the protective mechanism against acidosis by impairing special functions of the kidney cells. Distal convoluted tubule cells split urea and form ammonia which is used instead of circulating electrolytes to combat acidosis. Kidney cells also change disodium to monosodium phosphate which is excreted disposing of additional acid electrolytes. Carbonic acid anhydrase, an enzyme which promotes reabsorption of sodium bicarbonate and results in base preservation, prevails in the kidney cells and also in the gastric mucosa certain nerve tissues and the red blood cells. This final barrier against acidosis is active in several body areas.

Lumbar sympathectomy itself has no untoward effect on bowel function.[3] The recumbent position may adversely affect the patient whose urine is dripping into the large bowel.[4] In this position the urine may spread over a larger absorptive surface. In the case here reported, this may have occurred on the day of the patient's second admission, when he was apparently well early in the morning and went into acidotic coma while taking a nap.

Modern anesthesiologic technic assures survival of the average patient after an operation. Today, surgical indications are many. In a cystectomized patient, physiologic reserve may not be easily estimated and appearances may be deceptive. Surgical science and conscience must enter into preoperative judgment.

## SUMMARY

Survival after a radical organ-sacrificing operation for malignant disease may occur by virtue of multiple compensatory physiologic mechanisms. Well-being may depend on physiologic mechanisms already pressed to the limit; the burden of additional surgical procedures may lead to untoward result.

## RIASSUNTO

Dopo operazioni che asportino radicalmente interi organi per neoplasie maligne, la sopravvivenza è condizionata all'entrata in funzione di molti meccanismi fisiologici di compensazione. Lo stato di buona salute può derivare dal fatto che tali meccanismi siano stati impiegati dall'organismo al loro massimo grado; si comprende, pertanto, facilmente come ulteriori interventi chirurgici possano dare sfavorevoli risultati.

## RÉSUMÉ

La survie après ablation radicale d'un organe à la suite d'une affection maligne, peut être expliquée par de multiples mécanismes physiologiques de compensation. C'est la raison pour laquelle de nouvelles indications opératoires peuvent provoquer l'effet contraire.

### SUMARIO

A sobrevida após a cirurgia radical nos casos de tumor maligno pode ocorrer com o auxílio de múltiplos mecanismos fisiológicos compensatórios. O bem estar do paciente pode depender dos mecanismos fisiológicos já esgotados e a cirurgia adicional pode levar à resultados indesejáveis.

### RESUMEN

Después de una operación radical en que se sacrifican órganos por padecimientos malignos, puede producirse la supervivencia del paciente en virtud de múltiples mecanismos fisiológicos compensadores. El bienestar puede depender de mecanismos fisiológicos funcionantes al límite; el exceso impuesto por una operación más puede conducir a resultados fatales.

### ZUSAMMENFASSUNG

Radikale mit Opferung von Organen einhergehende chirurgische Eingriffe zur Behandlung bösartiger Erkrankungen könenn man vielfacher kompensatorischer physiologischer Mechanismen überlebt werden. Das Wohlbefinden solcher Kranken beruht auf physiologischen Mechanismen, deren Kapazität bis an die Grenze des Möglichen beansprucht wird; eine weitere Belastung durch zusätzliche chirurgische Eingriffe kann zu ungünstigen Resultaten führen.

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Rhythmless speech or writing is like the flow of liquid from a pipe or tap; it runs with smooth monotony from when it is turned on to when it is turned off, provided it is clear stuff; if it is turbid, the smooth flow is queerly and abruptly checked from time to time, and then resumed. Rhythmic speech or writing is like waves of the sea, moving onward with alternating rise and fall, connected yet separate, like but different, suggestive of some law, too complex for analysis or statement, controlling the relations between wave and wave, waves and sea, phrase and phrase, phrases and speech. In other words, live speech, said or written, is rhythmic and rhythmless speech is at the best dead. The rhythm of verse is outside the scope of this book, and that of prose cannot be considered in its endless detail; but a few words upon it may commend the subject as worth attention to some of those who are stirred by the mere name to ribald laughter at fads and esthetes.

—*Fowler*

# Thyroidectomy for Struma Lymphomatosa Hashimoto's Disease

## Report of a Case with Unusual Operative Complications

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HASHIMOTO'S disease is no longer a rare lesion of the thyroid gland infrequently treated by operation. Marshall[1] described 78 cases from the Lahey Clinic in 1948; Joll[2] of Great Britain reported 81 cases; Chesky[3] collected 146 cases in 1951, and Blake[4] 16 cases from private practice alone. Many cases have also been reported by McSwain[5] and other authors.

Because hardness of the gland is observed on clinical examination, operation is usually essential to rule out the possibility of malignant change. In some instances symptoms of pressure on the trachea are disturbing enough to warrant surgical intervention. In the case to be described here there were no unusual pathologic or clinical observations before the operation; after it, however, several interesting surgical complications developed. The immediate recognition of these unexpected complications and their treatment undoubtedly resulted in the patient's eventual recovery.

In 1912 Hashimoto[6] reported 4 cases of a peculiar type of lymphoid goiter which, in his opinion, was "a growth of the lymphatic elements and a formation of lymphoid follicles together with certain changes both in the parenchyma and in the interstitial tissue of the excised gland." This he called struma lymphomatosa. However, sixteen years earlier, Riedel, a German surgeon in Jena, published a report of 2 cases in which the gland was wood-hard and densely adherent to the trachea and the surrounding blood vessels and nerves. He stated that this made it difficult to distinguish it from a malignant lesion. Hashimoto, however, was aware of the absence of inflammatory reaction in his case, as well as the lack of adherence to surrounding structures. Some time later, Ewing[7] concluded that Hashimoto and Riedel described early and late stages of the same pathologic process. Marshall offered a more logical classification and stated that there are three types of chronic thyroiditis. The first type is inflammation of the thyroid gland in the true sense, namely, inflammation of the gland caused by actual infection. The terminal or healed stage of this type of thyroiditis, he said, had been known as Riedel's struma. The second type he designated as struma lymphomatosa, which is distinct and separate from thyroiditis caused by infection. The third type is characterized by indefinite mild inflammatory changes and must be classified as nonspecific thyroiditis.

In the presence of struma lymphomatosa the gland is invariably enlarged. The pyramidal lobe, as well as substernal prolongations, participates in this general increase of size. Commonly there is considerable enlargement posteriorly, so that

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the two lobes meet or even overlap behind the pharynx, larynx and esophagus ("circular goiter"). This results in anteroposterior compression of the trachea, which, however, rarely accounts for serious dyspnea. The surface of the gland is smooth and slightly lobulated, the lobulations being merely an exaggeration of the normal contour. The superficial veins are not as large as those observed in cases of toxic or nodular goiters of comparable size, and the capsule, though slightly thickened, is smooth externally. There is no evidence of adherent muscular or fascial tissue as there is in the chronic thyroiditis described by Riedel. Nor is there anything to indicate a direct fibrous infiltration of the tracheal wall by the goiter. In cases of struma lymphomatosa the consistency of the gland is uniform throughout, and in the late stages it is never "iron hard" or "woody" as with Riedel's disease. On section in the earlier stages the tissue may be as friable as a lymph node; only in the advanced stages can it be said to grate on the knife, little if any tissue being then expressible. In color the gland tissues vary from the palest pink to yellowish white, with a distinct brownish tinge in certain specimens.

Microscopically, there is marked infiltration of the stroma, with lymphoid cells and the formation of numerous secondary lymph follicles. Atrophy and marked acidophilia of the ephithelium are also present. Occasionally there is some degeneration of colloid, with foreign body giant cell reaction. The changes are widespread, so that in all parts of the gland the appearances under the microscope are similar. Since differences in detail are possible according to the stage reached by the disease, as Hashimoto himself has stated, Ewing and others may have been misled into assuming that in the final fibrotic stage the condition is pathologically identical with Riedel's di[illegible]

Clinically the goiter in cases of Hashimoto's disease is moderate-sized, and develops over a period of several months before pressure symptoms are felt. There is seldom any pyrexia or other evidence of inflammation at the onset. The history reveals no preceding acute illness, and no toxic or infective state, general or local. Fatigue, shortness of breath and increase of weight are common symptoms, but they can be ascribed partly to direct pressure and partly to the hypothyroid tendency so often revealed when the basal metabolic rate is estimated. Pressure symptoms are seldom prominent unless the goiter is exceptionally large and has caused bilateral or anteroposterior compression of the trachea. Laryngeal paralysis is too rare to be considered.

In summary, the diagnosis of struma lymphomatosa should be considered if one is presented with the following picture in a middle-aged patient, usually a woman: a firm goiter reaching its maximum size in a few months; involvement of every part of the gland, and moderate dyspnea without any serious pressure effects. On the other hand, there is noted thyrotoxic symptoms are absent, as are such inflammatory phenomena as pain, tenderness and pyrexia. To this description should be added the lack of any evidence of involvement of extrathyroid tissues and the presence of some degree of hypothyroidism.

The most important condition from which Hashimoto's disease must be differentiated is carcinoma of the thyroid. In the presence of malignant goiter the gland is irregularly hard, with encroachment upon the extrathyroid tissues, involvement of the main vessels and nerves and possibly enlargement of the lymph glands. Nevertheless, the two conditions are often confused, as was noted by Emerson,[8] who [illegible] that, of 9 lesions re[illegible] as [illegible] struma, 5 were diagnosed wrongly as malignant goiter.

Operative treatment is indicated (1) to make certain that the condition is not a malignant neoplasm; (2) to remove an unsightly mass from neck, and (3) to relieve pressure symptoms. After exposure of the gland in the operating room, it is usually possible to rule out carcinoma on the basis of the gland's gross appearance. If in doubt, one may resort to a frozen section, since a delay of a few minutes is not harmful to the patient.

When the operation is performed to relieve pressure on the trachea, or for cosmetic reasons, a subtotal thyroidectomy is indicated. In order to secure almost all the tumor and to obtain adequate relief of pressure, full mobilization of both lobes must be accomplished, especially laterally, so that the anteroposterior compression of the trachea is eliminated. A total thyroidectomy is unnecessary, and a small segment may be left posteriorly on either side to spare the parathyroids and to protect the recurrent laryngeal nerves. As in all thyroid operations, we never use endotracheal tubes and always utilize general anesthesia. We do not proceed to removal of the second lobe until the anesthetist is certain that the vocal cord on the resected side is functioning. In cases of Hashimoto's disease one must bear in mind that the resection should be extensive enough to relieve pressure symptoms, to prevent recurrence of growth and to avoid the postoperative appearance of a mass protruding in the neck.

Postoperatively, four-fifths of all patients with struma lymphomatosa show hypothyroidism with symptoms of myxedema, which necessitates the taking of 1 to 3 gr. of thyroid extract daily. In his review of 78 patients with Hashimoto's disease operated upon at the Lahey Clinic, Marshall reported that 2 also required temporary tracheotomy after the operation. In his opinion, this procedure was necessary because of laryngeal edema arising postoperatively in myxedematous patients. In the case to be described here, however, no edema of the larynx or trachea was present at operation. The difficulty in breathing became evident just as the second lobe was being removed. This probably resulted from the trachea's being deprived of the support furnished by the large, hard, circumferentially growing goiter. The trachea then suddenly collapsed and was unable to maintain a lumen patent enough for breathing.

## REPORT OF A CASE

Mrs. B. B., a 48-year-old housewife, was admitted to the Boulevard Hospital on Aug. 18, 1953, because of a lump in the front of the neck. She had had no serious illness except for occasional infections of the upper part of the respiratory tract. She had had repeated attacks of disease of the gallbladder, for which a cholecystectomy was performed in May 1949. In December 1944 she had undergone total hysterectomy for bleeding fiboids.

For the past year and a half she had observed a gradual increase in the size of the front part of her neck, and had been informed that her basal metabolic rate was normal. She suffered no accompanying loss of weight or strength. Her only other complaint was difficulty in swallowing solid food for the past few months. The patient had been aware that the food apparently met an obstruction in the throat during its passage into the stomach. Immediately after leaving the mouth, the food seemed to strike a "bump," after which it proceeded downward in the usual manner. However, in general she considered her health good enough to permit her to accomplish her daily work as housekeeper in a doctor's office.

On physical examination, she appeared well nourished and healthy. There were abdominal scars from the aforementioned cholecystectomy. The neck region was short and full, enlarged thyroid lobes were palpated anteriorly and laterally. The thyroid tissue seemed firm, smooth, and without the hard nodular character of a carcinomatous gland. No enlarged nodes were palpable along the line of the cervical lymph glands.

The blood pressure in millimeters of mercury

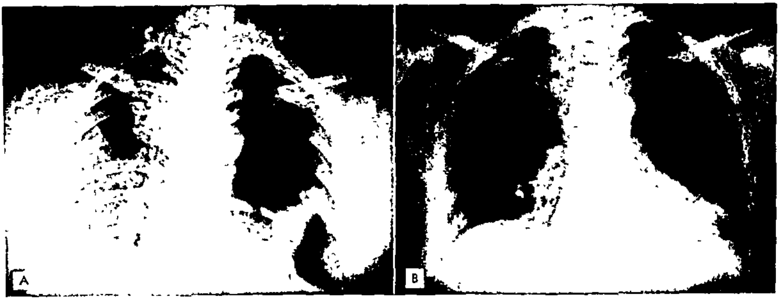

Fig. 1.—*A*, left pneumothorax, almost complete. Roentgenogram taken about one and one-half hours after operation was completed. No mediastinal shift present. *B*, complete reexpansion of the lung nineteen days after the operation.

was 122 systolic and 88 diastolic. The pulse was regular and of good quality, with a rate of 76. The respirations were 20 per minute, with no sign of respiratory embarrassment. The temperature was within normal limits. The blood count upon admission showed 14.5 Gm. of hemoglobin, 5,150,000 erythrocytes and 9,900 leukocytes, per hundred cubic centimeters, with 66 per cent polymorphonoclear neutrophils, 30 per cent lymphocytes and 4 per cent monocytes. Urinalysis on admission revealed no abnormality whatever. Operation was decided upon (1) to remove the bulging tumor of the neck, (2) to ascertain whether carcinoma of the thyroid was present and (3) to relieve the difficulty in swallowing.

At the operation, which was performed on the next day, a diffusely enlarged thyroid gland was exposed, with an increase in size even of the pyramidal lobe. The gland was firm and smooth, but not nodular or "stony" hard. About one third of each lobe presented above the level of the clavicles and two thirds below, resting upon the clearly visible apexes of the parietal pleurae. The isthmus participated in the generalized glandular enlargement. Nowhere was the thyroid gland adherent to surrounding tissues. It was readily observed, however, that the hypertrophied thyroid tissue extended not only anteriorly and laterally but posteriorly, which accounted for the symptom of difficulty in swallowing. The two lobes seemed to meet in the midline posteriorly.

The incision was the usual transverse neck incision for exposing the thyroid gland. The right lobe was thoroughly freed and partially resected. A small wedge-shaped segment was left posteriorly. Since the patient was under cyclopropane inhalation anesthesia, the anesthetist was able to ascertain the condition of the right vocal cord. This was functioning well, as was also the left cord. The dissection then proceeded to the left lobe, where there were similar infiltrations of gland tissue posteriorly and also below the clavicle. Here also a wedge-shaped portion of the gland was left posteriorly, and the remnant of the thyroid lobe was sutured as on the right side. No pleural opening was observed even after saline solution had been poured into the wound. Just before resection of the left lobe was completed, however, the anesthetist noticed signs of respiratory distress with cyanosis. A second inspection of the larynx nevertheless showed both vocal cords functioning properly.

As soon as the operation was over and the patient was about to be transferred downstairs to her room, the breathing became more labored and the color of the skin changed to a deeper blue. An endotracheal tube was inserted without any difficulty, and immediately the patient's color was less cyanotic. Repeated examinations of the chest gave negative results for pneumothorax up to this point in the immediate postoperative course. Now, however, the signs of a left partial pneumothorax were becoming evident. An emergency roentgenogram revealed extensive collapse of the left lung, but no shift in the position of the mediastinum (Fig. 1). Decompression of the left pleural space, therefore, was not attempted, since marked positive intrapleural pressure was not present.

The endotracheal tube remained in place for one and a half hours and was then removed. Immediately the airways became obstructed again, and the patient was deeply cyanotic. She was quickly returned to the operating room, where a decision was made to perform an immediate tracheotomy rather than risk the patient's life by using less radical and less secure measures. The wound was reopened; the tracheal rings were exposed with ease, and a vertical incision was made through the second and third tracheal ring cartilages. The patient's skin became pink as soon as the trachea was opened, and the breathing was quiet and slow. A No. 5 tracheotomy tube was inserted, and the deep fascia and skin were later reapproximated. Convalescence was uneventful, the tracheotomy tube was removed permanently on the fifth day, and the patient resumed normal breathing. Repeated laryngeal examinations revealed no restriction in movement of the vocal cords. Serial chest roentgenograms taken after the operation showed complete reexpansion of the left lung within ninteen days (Fig. 2), after which time the patient was discharged from the hospital with only a very small neck dressing. Follow-up visits revealed her to be well, with normal breathing and a normal-sounding voice.

*Pathologic Picture.*—Grossly, the specimen consisted of three lobes of thyroid, the first measuring 82 by 46 by 34 mm. The capsule was covered by adhesive strands, and the parenchyma was extremely firm. On section, the cut surface presented fairly distinct lobular markings; its color ranged from gray to grayish pink. Little colloid substance was seen. The second lobe measured 59 by 32 by 22 mm. It had a structure similar to that of the first one. The third lobe was pyramidal, measuring 29 mm. in cross section and also firm. Microscopically the acini were seen to be replaced and compressed by large accumulations of lymphocytes arranged both diffusely and in large lymph follicles. There were also fairly broad strands of dense fibrous tissue intersecting the gland.

## COMMENT

A case is described of Hashimoto's disease in a 48-year-old woman of a bulging mass in the front of the neck and awareness of an obstruction to swallowing in this region. Operation was not unusually difficult but was immediately complicated by tracheal obstruction and left pneumothorax. A thoracic roentgenogram ruled out the pneumothorax as the cause of the patient's asphyxia, since the mediastinum was not shifted to the opposite side. An endotracheal tube, later replaced by a tracheotomy tube, was necessary for adequate breathing. The cause of the difficulty in respiration can be explained by the fact that the trachea, after being dissected free of its supporting collar of hard thyroid tissue, was unable to remain suspended in the neck in a fully patent position. Partial angulation and collapse of the trachea resulted, with serious interference with the passage of air. The left pneumothorax was a coincidental complication and of no serious consequence.

## CONCLUSIONS

A case of Hashimoto's disease (struma lymphomatosa) is reported in detail because of the occurrence of two interesting postoperative complications: tracheal collapse with obstruction to breathing, requiring a temporary tracheotomy tube, and pneumothorax.

Hashimoto's disease is no longer rare in any large series of thyroidectomy operations. Pathologically it is not related to inflammation or infection. The commonest symptoms are enlargement of the thyroid gland, pressure symptoms and manifestations of hypothyroidism.

The condition must be differentiated from chronic thyroiditis, which shows infiltration and adherence to extrathyroid tissues; and from carcinomatous thyroid, which is harder and nodular. In most cases subtotal thyroidectomy must be performed to rule out carcinoma, to relieve pressure symptoms and to remove an unsightly neck bulge.

### RESUMEN

Se comunica en detalle un caso de enermedad de Hashimoto (struma linfomaosa) a causa de la ocurrencia de dos ineresantes complicaciones postoperatorias, olapso traqueal con obstrucción respiraoria, requiriendo un tubo de traqueotomía neumotórax.

La enfermedad de Hashimoto ya no es na rareza en las grandes series de tiroiectomías. Anatomopatológicamente no se ncuentra relacionada a la inflamación de nfección. Los síntomas más comunes son recimientos del tiroides, síntomas compresivos y manifestaciones de hipotiroidismo.

El padecimiento debe diferenciarse de la iroiditis crónica que muestra infiltración y adherencia a los tejidos extratiroideos y el carcinoma del tiroides que es más duro y nodular. En la mayoría de los casos se ealiza tiroidectomía subtotal para eliminar la posibilidad de carcinoma, liberar la ompresión y extirpar la tumoración del uello.

### RIASSUNTO

Viene descritta dettagliatamente un'osservazione di malattia di Hashimoto a causa di due interessanti complicazioni post-operatorie: un collasso della trachea con conseguente ostruzione respiratoria (che richiese una tracheotomia) e un pneumotorace. La malattia di Hashimoto non è più così rara nelle casistiche numerose. Dal punto di vista patogenetico non è in rapporto nè con l'infiammazione nè con le infezioni; i suoi sintomi più comuni sono rappresentati dall'aumento di volume della ghiandola, dai disturbi da compressione e dall'ipotiroidismo. L'affezione deve essere tenuta distinta dalle tiroidi croniche (che presentano segni di infiltrazione e di aderenza ai tessuti circostanti) e dai tumori, che sono più duri e nodosi. In molti casi si deve eseguire la tiroidectomia su[illegible]otale per togliere i disturbi da compressione ed eliminare una sgradevole tumefazione del collo.

### RÉSUMÉ

Les auteurs rapportent un cas de maladie de Hashimoto (goître lymphomateux) avec tous ses détails à cause de deux complications post-opératoires très intéressantes : affaissement de la trachée avec obstruction respiratoire, exigeant une trachéotomie temporaire et un pneumothorax.

La maladie de Hashimoto n'est plus une rareté dans toute statistique importante d'opérations thyroïdiennes. Au point de vue pathologique, elle n'est pas en relation avec une inflammation ou une infection. Les symptômes les plus courants sont l'augmentation de volume de la glande thyroïde, des symptômes de compression et des manifestations d'hypothyroïdisme.

Il faut différencier cette affection de la thyroïdite chronique, qui montre une infiltration et des adhérences aux tissus extra-thyroïdiens, et du carcinome thyroïdien qui est plus dur et nodulaire. Dans la plupart des cas il faut pratiquer une thyroïdectomie subtotale, afin d'exclure : le carcinome, les symptômes de compression et le goître inesthétique.

### SUMARIO

Um caso de doença de Hashimoto (struma linfomatoso) é relatado com detalhes por causa da ocorrência de duas interessantes complicações pós-operatórias: colapso traqueal com obstrução da respiração exigindo uma traqueotomia temporária, e pneumotórax.

A doença de Hashimoto não é muito rara em grandes séries de operações da tireóide. Patològicamente ela não está relacionada à inflamação ou infecção. Os sintomas mais comuns são o aumento da glândula tireóide, sint[illegible]as de compressão e [illegible]es de h[illegible]mo.

Esta condição deve ser diferenciada da tireoidite crônica que mostra infiltração e aderência aos tecidos extra-tireóideos; do carcinoma da tireóide que é nodular e mais duro. Na maioria dos casos tiroidectomia subtotal deve ser realizada de modo a excluir o carcinoma, aliviar os sintomas e remover a glândula.

### ZUSAMMENFASSUNG

Es wird ein detaillierter Bericht über einen Fall von Hashimotoscher Krankheit (Struma lymphomatosa) gegeben, weil zwei interessante postoperative Komplikationen auftraten, nämlich ein Luftröhrenkollaps mit Verstopfung des Atmungsweges, die eine temporäre Luftröhrenkanüle erforderlich machte, und ein Pneumothorax.

In grösseren Serien von Schilddrüsenresektionen stellt die Hashimotosche Krankheit keine Seltenheit mehr dar. Pathologisch besteht weder zur Entzündung noch zur Infektion eine Beziehung. Die häufigsten Krankheitserscheinungen sind Schilddrüsenvergrösserung, Drucksymptome und Zeichen von Hypothyreoidismus.

Die Erkrankung muss unterschieden werden von chronischer Schilddrüsenentzündung, bei der eine Infiltration und Verwachsung des extrathyreoiden Gewebes besteht, und von der krebsigen Schilddrüse, die knotig und härter ist. In den meisten Fällen ist eine subtotale Schilddrüsenresektion notwendig, um einen Krebs auszuschliessen, die Drucksymptome zu erleichtern und eine hässliche Halsgeschwulst zu beseitigen.

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Life begins then with a tissue of inherited values. Only by hard effort and experiment does one reach the matter-of-fact plane: indeed, the sense of a neutral world, untouched by man's efforts, indifferent to his activities, obdurate to wish and supplication, is one of the supreme triumphs of his imagination, and in itself represents a fresh human value.

—*Mumford*

# A New Bipolar Electrocoagulator for Hemostasis

CARLO SCUDERI, M.D., Ph.D., F.A.C.S., F.I.C.S.

CHICAGO, ILLINOIS

FOR ten years I have been using a bipolar electrocoagulator for hemostasis, with excellent results. My experience includes both military and civilian cases numbering in the thousands.

Numerous types of coagulators were used and experimented with over the years. But not until the present one was made (dePuy Co.) did the equipment withstand sterilization and use for any length of time without breaking down and requiring frequent repairs.

Monopolar electrocoagulation has been in use for over thirty-five years and has been received favorably by the surgical profession.

Bipolar electrocoagulation serves the same purpose of absolute hemostasis and in addition has the following advantages:

1. No plaque (lead plate) is required to be in contact with the patient in order to complete the electrical circuit. This eliminates the danger of burning the patient if a spark gap should occur in the presence of perspiration.

2. It is not necessary to catch the bleeding point with a hemostat and then remove the hemostat after coagulation. The bleeding point is pinched between the ends of the forceps, then the current passes through and coagulation takes place with the minimal number of maneuvers and least consumption of time.

3. Should it be necessary to recoagulate a bleeding point, this can be done with the use of only one instrument and a few seconds of time.

This bipolar electrocoagulator can be sterilized either in the autoclave or by cold sterilization. The rubber parts will last indefinitely if cold sterilization is used.

The Bovie electrical unit or any similar machine serves as the basic unit to which the two electrodes from the electrocoagulating forceps are inserted. One terminal end is inserted into the adaptor of the Bovie labeled "patient" and the other to the adaptor labeled "electrode." Thirty-five to forty on the dial is usually sufficient for producing a spark of adequate intensity. Occasionally, owing to local circumstances (current load, type of machine, etc.), a little more or a little less current is necessary. A few trials at the time of operation will enable the surgeon to select the amount of electrical current required. The foot switch permits the surgeon to turn the current on and off as he desires, without requiring additional help and without the need of picking up and laying down other instruments. The procedure can be carried out rapidly and accurately. It eliminates the time necessary for the tying of ligatures and also for burying foreign material, such as catgut, silk or cotton, which might later cause a foreign body reaction.

In many orthopedic and neurosurgical operations for which absolute hemostasis is necessary, bipolar electrocoagulation is [illegible] This [illegible] ue if [illegible]ra-

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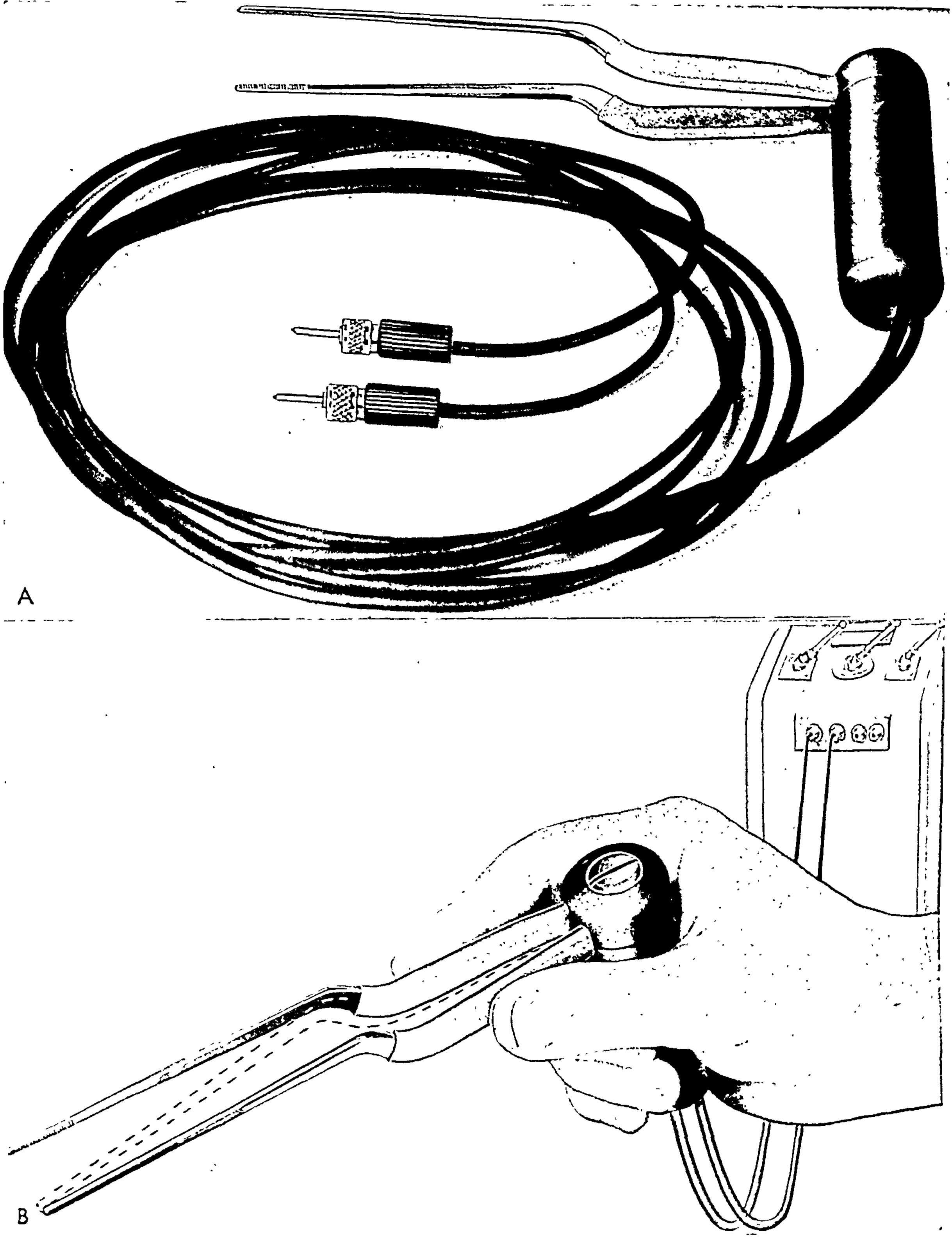

Fig. 1.—*A*, electrocoagulator as an independent unit. It consists of a bayonet forceps with a pistol grip, an electrical cord and the two terminal plugs. *B*, terminals plugged into machine, the surgeon holding the forceps in his hand. The foot switch is on the floor next to the surgeon's right foot. The current to the machine is turned on, and the bipolar electrocoagulator is ready for use. The current to the forceps is controlled by the foot switch.

tion is being carried out at a depth where ligation is difficult or impossible, or in tissue that will not tolerate ligation. In operations on the brain, spinal cord or the herniated disc and in operations about the head or neck of the femur and acetabulum, electrocoagulation is priceless.

There is the theoretical disadvantage of the open spark created by this method. In the ten years during which I have been using this method no undesirable results have occurred. The use of apparatus is no more dangerous than the employment of a motor saw in the removal of a bone graft, the striking of a metal hammer against a metal chisel, or the use of the electrosurgical unit in a prostatic resection. It would certainly be imprudent, however, to use electrocoagulation in or about the nasal or oral passages when some form of inhalation anesthesia is being used.

Large blood vessels or major arteries must be ligated, for two reasons:

1. It is impossible to electrocoagulate an area in which much bleeding is present, because, owing to dissipation of the heat, the local tissues cannot be brought up to the temperature of coagulation.
2. Secondary bleeding is apt to occur in large vessels when the coagulated area is under constant systolic pressure during the healing process.

SUMMARY

The author presents the advantages of bipolar over monopolar electrocoagulation, as judged on the basis of ten years' military and civilian experience. For many orthopedic and neurosurgical procedures he considers it ideal, since such operations often involve tissue too deep for successful hemostasis by ligation.

RIASSUNTO

Basandosi su un'esperienza decen [illegible] civilee militare, l'autore se [illegible] dell'elettrocoagulazione bipolare nei confronti di quella monopolare. Egli considera tale sistema come ideale in molti interventi ortopedici e neurochirurgici, giacchè tali operazioni si svolgono spesso su tessuti troppo profondi da permettere una sicura emostasi per legatura.

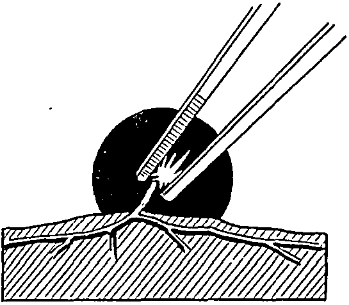

Fig. 2.—Line drawing to show how electrocoagulation of a bleeder is produced. The bleeding vessel is held between the ends of the forceps. When the current is contacted a spark jumps across the ends of the forceps. The heat generated by the spark coagulates the soft tissue in the immediate area.

RÉSUMÉ

L'auteur présente les avantages de l'électro-coagulation bipolaire sur l'électro-coagulation monopolaire, en se basant sur 10 ans d'expérience militaire et civile. Il considère ce procédé comme idéal pour nombre d'interventions orthopédiques et neurochirurgicales, étant donné que lors de telles opérations on doit faire une hémostase de tissus qui sont parfois très *profonds.*

SUMARIO

O autor apresenta as vantagens da eletrocoagulação bipolar sôbre a monopolar, baseado numa experiência de 10 anos de prática militar e civil. [illegible] r, muitos métodos ortopédicos e ne [illegible] cos êle o consi [illegible] desd [illegible] erações

incluam tecidos profundamente situados em que a hemostasia por ligadura é difícil.

RESUMEN

Un nuevo electrocoagulador bipolar para hemostasis.

El autor presenta la ventajas de la electrocoagulación bipolar sobre la monopolar, basándose en la experiencia civil y militar de diez años.

La considera ideal para muchos procedimientos ortopédicos y neuroquirúrgicos, dado que en los mismos se afecta muchas veces demasiado profundamente el tejido para obtener la hemostasis satisfactoria por ligadura.

ZUSAMMENFASSUNG

Der Verfasser gibt eine Darstellung der Vorzüge der bipolaren Elektrokoagulation gegenüber dem monopolaren Verfahren. Sein Urteil beruht auf einer zehnjährigen Erfahrung im Militärdienst und im zivilen Leben. Für viele orthopädische und nervenchirurgische Eingriffe sieht er in der bipolaren Elektrokoagulation das ideale Verfahren, da diese Operationen sich oft auf Gewebe ausdehenen, die zu tief liegen, um eine sichere Blutstillung durch Unterbindung zu gestatten.

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But the supreme mistake made by the European psychologist in summing up the American character is the mistake of assuming that the superficial braggadocio of this polyglot people is anything but skin-deep. In one generation from his incoming a strange new reserve establishes itself in the nature of an immigrant; a reserve that underlies all his *brio* and all his effusive slang. This is the primitive reserve of America. This is the mood of the high cheek-bones and caustic lips of the old aboriginals. And it is a reserve that is totally concealed from the "reserved" Englishman and the ironic Frenchman—concealed by the engaging candor and oratorical pedantry of the men who hide it! Sometimes I dream that it is a reserve concealed even from its own possessors. But, such as it is, it shares its secret with the astounding natural features of the land that evokes it. If American *culture* has a vaporous fluidity which it derives from its emancipated womanhood, American *character* has a rooted withdrawnness which it derives from its overworked manhood. Whatever may be felt about a civilization that combines such elements, the present writer cannot conceal his premonition that, in Walt Whitman's quaint and characteristic jargon, "divine things well-enveloped" are likely to be its issue.

—*Powys*

# Section on Ophthalmology and Otorhinolaryngology

PAUL C. CRAIG, M.D., F.A.C.S., F.I.C.S.

# Axis Traction Cataract Extraction with Vacuum

OSCAR B. NUGENT, M.D., F.A.C.S., F.I.C.S.,
AND JOHN W. VERTUNO, M.D., F.I.C.S.
CHICAGO, ILLINOIS

MUCH has been said and written about the removal of a cataract since the first extraction was described by Daviel, and one may ask, "Can there be enough change in the technic to warrant the writing of another paper on the subject?" In our opinion, sometimes even a very slight change in the technic is of great value and may mean the difference between success and failure.

As time goes on, slight changes are made and often found to have value; they then become incorporated in the regular technic, and in the course of a few years the whole technic has an entirely new form. On several occasions, doctors who formerly attended our surgical clinic have remarked how much our technic had changed, while we had scarcely noticed it.

This paper has to do with the technic we now employ, with which we have obtained our best results. By "best results" we mean reduction in the incidence of iris adhesions to the wound; iris incarceration and prolapse; reduction in the incidence of hyphemia; a greater increase in the number of round pupils; reduction of postoperative astigmatism, and the attainment of better visual results. We have also been able, as a result of our technic and experience, to reduce the incidence of such operative complications as loss of vitreous and broken capsules.

*Preliminary Preparation.*—A complete history of past illnesses is obtained from the patient and from the family doctor, as well as an account of the present state of health. The physician in attendance is asked to make a physical examination of the heart, lungs, kidneys, etc. Urinalysis and a complete blood examination are made. Roentgenograms of the teeth and sinuses are obtained. The whole procedure is explained to the patient—how long he must remain in bed, the extent of pain and discomfort he must expect during the surgical procedures and convalescence. All his financial obligations are arranged before operation is attempted.

It is our experience that patients do better when all the worry and uncertainty have been reduced as much as possible. All the preliminaries are attended to from one to three days prior to the operation.

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From the Ophthalmic Department of the Chicago Eye, Ear Nose and Throat Hospital.

Read before the Section of Ophthalmology rh laryngology of the International College Paulo, Brazil, April 30, 1954.

Submitted for publication April 30, 1

sary the patient is given an enema, and a mild sedative is administered at bedtime. Little or no company is allowed during the evening preceding the day of operation. At bedtime homatropine is instilled into the eye to be operated on. All efforts are made by the night nurses to keep the patient quiet and to encourage sleep.

*Morning of Operation.*—Neosynephrin (10 per cent) is instilled, beginning about two hours before the operation and repeated every half hour. The patient is given a light breakfast of tea and toast and 5 gr. of barbital is administered about half an hour before the operation. The patient is transfered to the operating room in a wheel chair and placed on the operating table. Pontocaine (0.5 per cent) is instilled in the eye every five minutes for four instillations. The eyelashes are cut, and the face is washed with soap and water and painted with 3 per cent iodine solution neutralized with 70 per cent alcohol.

The patient is draped and the local anesthetic is injected as follows: 1 or 2 drops of 2 per cent procaine hydrochloride is injected with a ½-inch, 25-gauge needle, first into the conjunctiva over the superior rectus muscle, about 10 mm. above the limbus, for anesthesia during the placing of the super-rectus bridle suture, also in the skin of the upper and lower lid, near the lid margin, at the center of the lid at the point where the lid sutures are to be placed. Another is placed at a point in the lower lid about 5 mm. below and to the nasal side of the external canthus, where the needle is inserted for the retrobulbar injection, and 1 in the skin 10 mm. to the temporal side of the external canthus and on a level with it, to accommodate the large needle for the Van Lint akinesis.

A retrobulbar injection of 3 cc. of a 2 per cent solution of procaine hydrochloride is made, and Van Lints akinesia is induced by injecting 6 cc. of a 2 per cent solution of procaine hydrochloride along the trunk of the seventh nerve and 3 cc. above and 3 cc. below the edge of the orbit. The superior rectus bridle suture is now put in place. The operating cloth is put in place after the lid sutures are put in. The lids are held with Fisher lid speculums by a trained assistant.

Irrigation of the conjunctival sac is then done, sterile distilled water being used.

*Operation.*—A conjunctival flap is made about 2.5 mm. from the limbus and parallel to it from 9 to 3 o'clock above. The flap is dissected down to the limbus, and a groove is made in the sclera as near to the base of the flap as is possible.

*Sutures.*—Five sclerocorneal mattress sutures (No. 7-0) are placed in the following manner; the mattress sutures are placed at 10, 11, 12, 1 and 2 o'clock as follows: beginning on the corneal side of the conjunctival flap at a point corresponding to 9:45 o'clock, a (No. 7-0) silk suture is inserted into the cornea near the flap passed under the base of the conjunctival flap and out in the corneal edge of the groove.

It is carried up to a point about 2 mm. above the groove and placed in the sclera parallel to the limbus from a point corresponding to 9:45 and brought out at a point corresponding to 10:15 o'clock; it is then passed back under the conjunctival flap at 10:15 o'clock, entering the corneal side of the groove and coming out in the cornea. The same procedure is done at 10:45 and 11:15 o'clock, and also at 12, 1 and 2 o'clock.

*Incision.*—The incision is started by using a small keratome at a point between 9 and 10 o'clock and is finished with corneoscleral scissors. While the assistant lifts the corneal flap, the surgeon grasps the edge of the iris at 12 o'clock with the utility forceps and, while drawing it down toward the center of the pupil, makes a

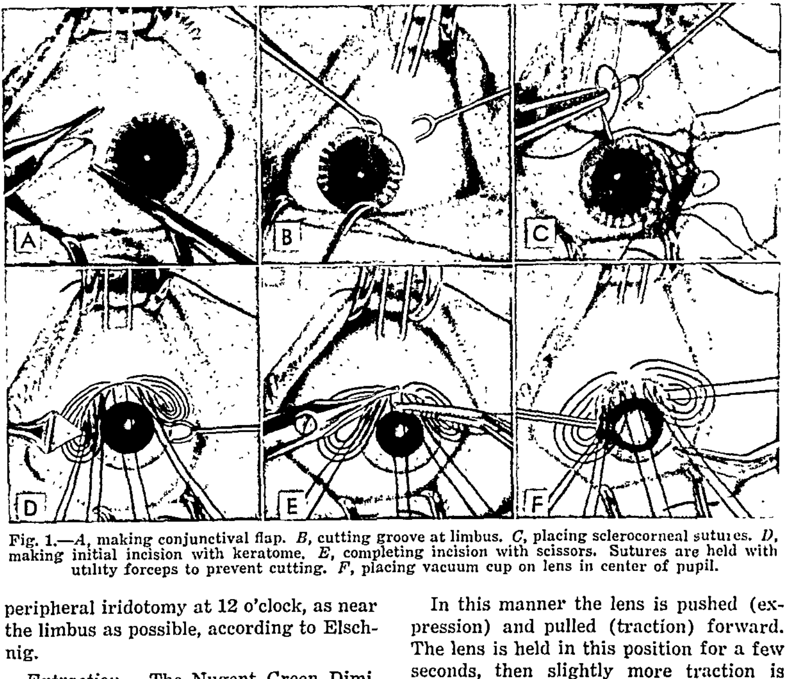

Fig. 1.—*A*, making conjunctival flap. *B*, cutting groove at limbus. *C*, placing sclerocorneal sutures. *D*, making initial incision with keratome. *E*, completing incision with scissors. Sutures are held with utility forceps to prevent cutting. *F*, placing vacuum cup on lens in center of pupil.

peripheral iridotomy at 12 o'clock, as near the limbus as possible, according to Elschnig.

*Extraction.*—The Nugent-Green-Dimitry vacuum cup is placed on the lens while the cornea is lifted with the utility forceps, the vacuum having previously been set to draw 42 cm., mg., and the vacuum is regulated by the oral vacuum valve. Four and one half seconds is required to build up the vacuum to 42 cm., mg., if the Nugent vacuum pump is used. The utility forceps is now closed and used as an expression instument on the limbus at 6 o'clock. Pressure is made at this point before traction on the lens is begun. The lens is now drawn outward in the line of the visual axis, very little traction being made at the start, and as the lens is pushed forward by pressure with the utility forceps the traction is gradually increased.

In this manner the lens is pushed (expression) and pulled (traction) forward. The lens is held in this position for a few seconds, then slightly more traction is made. At this point the zonula fibers are being broken.

As soon as the lens comes up so that its edge can be seen behind the edge of the pupil, the vacuum cup is slightly tilted in such a manner as to free the upper edge of the lens so that it presents into the anterior chamber. It can then be drawn out through the incision. Broken capsules or loss of vitreous is seldom encountered.

*Wound Closure.*—When the lens has been delivered by the technic aforedescribed, there is seldom any need of using a spatula to replace the iris. The corneal flap is picked up with the utility forceps to free it completely from the iris.

In drawing up the loops of the sutures

two utility forceps are used. One, almost closed, is placed on the cornea, with the two ends of the mattress suture pulled between the blades in order to hold the cornea in place while the sutures are being drawn up; the other forceps is used to draw up the suture. The first suture to be drawn up is the one placed at 12 o'clock and the next two are those placed at 11 and 1 o'clock after which the other two are drawn up one at a time.

All sutures are drawn up. They are then tied in the same sequence in which they were drawn up. The tie is made by using the utility forceps. The ordinary square knot is all that is necessary.

The conjunctiva is now replaced and secured by means of a running untied suture. At this point the superior rectus bridle suture is removed, and a 0.5 per cent pilocarpine ointment is placed in the conjunctival sac and 5 per cent ointment of sulfadiazine over the wound. The lids are then closed and the lid suture tied; then 1 per cent yellow oxide of mercury is applied to the lids of each eye. A double patch is placed over the eyes and secured by means of Scotch tape. The operating table is wheeled to the hospital floor without transferring the patient to a stretcher, and the patient is transferred to bed.

*After-Treatment.*—A metal shield is placed over the surgically treated eye immediately after the patient is put to bed. The head is elevated about 20 degrees or slightly lower, as the patient desires. The

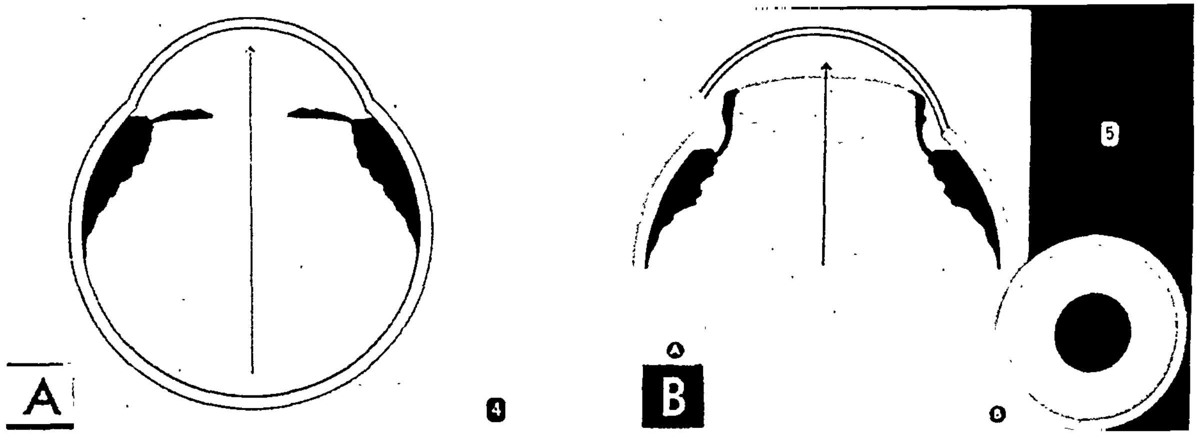

Fig. 2.—*A*, making traction in visual axis. *B*, line of traction, with resulting pupil.

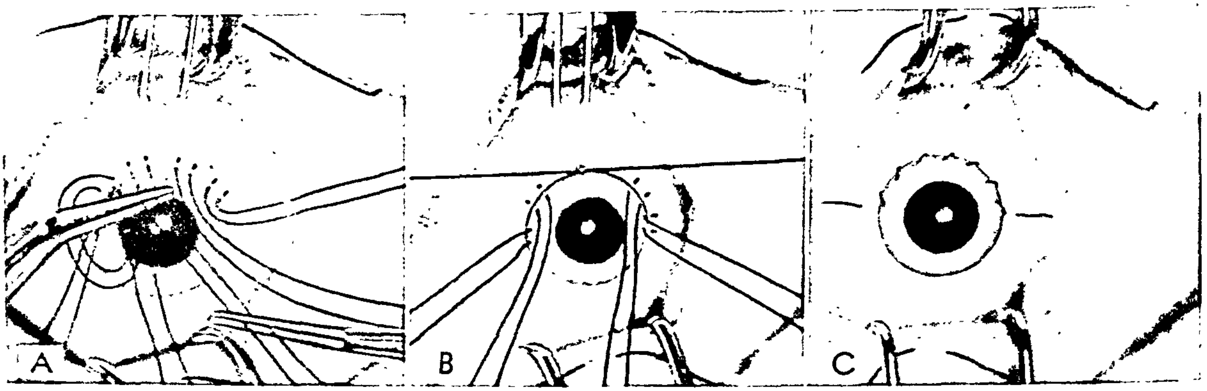

Fig. 3.—*A*, drawing up sutures with utility forceps while corneal flap is held in position by second utility forceps. *B*, tying first suture. *C*, completed operation after suturing of conjunctival flap.

patient may also be turned to the untreated side if he desires. He is kept as comfortable as possible for the next twenty-four hours, after which time the patches and the lid sutures are removed and the eye opened and inspected. Atropine ointment (1 per cent) is inserted and a patch placed over the eye that was operated on. No patch is placed over the untreated eye. The patient can sit up and have bathroom privileges for the remainder of his stay in the hospital, which is twelve or thirteen days. The patch is removed from the eye on the seventh day but is replaced at night.

The corneoscleral and conjunctival sutures are removed on the day of the patient's discharge, and his vision with a plus 10.0 lens and a pinhole disc is recorded.

Enough patches are supplied the patient to use at night during the first week at home, and he is instructed to do no work, to wear dark glasses and to return in one week. At that time the eye is inspected and the vision is again recorded, this time with a plus 10 lens and a pinhole disc. From this time on the patient is instructed to do only a little light work and not to use the eye patches.

From four to six weeks after the operation distance glasses are prescribed. In three or four weeks more bifocals are given and the patient can resume work.

## SUMMARY

Five corneoscleral (No. 7-0) sutures are used (the equivalent of ten single sutures), being placed a little less than 1.5 mm. apart. These secure the wound so that leakage is almost impossible. In addition, stresses on the wound by the extrinsic muscles, as in sudden movement or during vomiting, do not cause the wound to reopen.

The incidence of prolapse and of adhesions of the iris to the wound is reduced to a minimum. Other advantages are enumerated here, namely:

1. Hyphemia is greatly reduced.
2. A round pupil usually results.
3. Much freedom of action is given the patient during convalescence.
4. Broken capsules are almost never encountered.
5. Vitreous loss is reduced.
6. Postoperative astigmatism is greatly reduced.
7. Better visual results are obtained with a round pupil and the reduction of astigmatism.

## RESUMEN

Se usan cinco suturas esclerocorneales (7.0), equivalentes a dietz suturas simples, colocándose a no menos de 1.5 mm. entre sí. Esto asegura la herida de manera que el derrame sea practicamente nulo, además el estiramiento de la herida por los músculos extrínsecos no produce dehiscencia. La incidencia de prolap so y adherencias al iris se reduce al mínimo. Otras ventajas son las siguientes:

1. Se reduce grandemente la hiperemia.
2. Se produce una pupila circular.
3. Se dá mucha libertad de acción al paciente durante la convalescencia.
4. Casi nunca se encuentran pedazos capsulares.
5. Se reduce la pérdida vítrea.
6. Se reduce grandemente el astigmatismo postoperatorio.
7. Se obtienen mejores resultados visuales con una pupila circular y con la reducción del astigmatismo.

## RIASSUNTO

Vengono dati 5 punti di sutura corneosclerali (7.0), alla distanza di circa 1,5 mm. uno dall'altro. La ferita viene in tal modo garantita da un eventuale cedimento. Non si riapre in seguito a contrazione dei muscoli estrinseci come nei movimenti improvvisi o durante gli sforzi del vomito. Viene ridotta al minimo anche la possibilità di successivi prolassi o aderenze. Gli altri vantaggi sono:

1. Riduzione notevole dell'ifemia.
2. Conservazione di una pupilla rotonda.
3. Libertà di movimenti per il paziente durante la convalescenza.
4. Impossibilità di rottura della capsula.
5. Riduzione della prdita di vitreo.
6. Diminuzione dell'astigmatismo postoperatorio.
7. Migliori risultati funzionali.

### RÉSUMÉ

Cinq sutures originales de la cornée et de la sclérotique (7.0) sont utilisées (équivalent à dix sutures simples), à un peu moins de 1,5 mm. les unes des autres. Celles-ci protègent la plaie de sorte que l'écoulement est presque impossible. De plus, les pressions sur la plaie par les muscles extrinsèques, un mouvement brusque ou le vomissement empêchent la plaie de se rouvrir. La fréquence du prolapsus et des adhérence de l'iris est réduite au minimum. Les autres avantages sont les suivants:

1. Hémorragie rarissime dans la chambre antérieure de l'oeil.
2. Obtention en général d'une pupille ronde.
3. Grande liberté de mouvement au malade durant la convalescence.
4. La capsule est rarement déchirée.
5. Perte réduite de l'humeur vitrée.
6. Forte diminution de l'astigmatisme post-opératoire.
7. Résultats visuels meilleurs avec pupille ronde et diminution de l'astigmatisme.

### SUMARIO

Cinco suturas córneo-escleróticas (7.0) foram realizadas (o equivalente a dez suturas simples), sendo colocadas a menos de 1,5 mm. de distância. Estas mantêm a ferida, evitando a deiscência que se torna quase impossível. Além disso, tensões na ferida exercidas pelos músculos extrínsecos, como acontece nos movimentos ou durante os vômitos, não provocam a sua reabertura. A incidência de prolapso e aderência da iris são reduzidas ao mínimo. Têm ainda as vantagens seguintes:

1. A hifemia é muito reduzida.
2. Resulta em geral uma pupila redonda.
3. Maior liberdade de ação é dada ao paciente durante a convalescença.
4. Cápsulas quebradas raramente são encontradas.
5. A perda de transparência é reduzida.
6. O astigmatismo póo-operatório é muito reduzido.
7. Melhores resultados usuais são obtidos com a pupila redona e redução do astigmatismo.

### ZUSAMMENFASSUNG

Der Verfasser verwendet fünf korneosklerale 7,0) Nähte (das Aequivalent von 10 Einzelnähten), die er in Abständen von etwas weniger als 1,5 mm. anlegt. Diese Nähte ergeben einen so sicheren Schluss der Wunde, dass ein Sickern fast unmöglich ist. Darüber hinaus kommt es bsi plötzlicher Beanspruchung der Wunde durch die äusseren Muskeln, z.B. bei plötzlichen Bewegungen oder beim Erbrechen, nicht zum Aufplatzen der Wunde. Das Auftreten von Prolaps und Verwachsungen der Regenbogenhaut wird auf ein Mindestmass herabgedrückt. Weitere Vorzüge sind die folgenden:

1. Hyphaema wird weitgehend herabgesetzt.
2. Gewöhnlich erzielt man eine runde Pupille.
3. Der Patient geniesst eine grosse Bewegungsfreiheit in der Rekonvaleszenz.
4. Kapselbrüche kommen fast niemals vor.
5. Das Vorkommen von Verlust der Glaskörper flüssigkeit wird verringert.
6. Das Auftreten von postoperativem Astigmatismus wird erheblich eingechränkt.
7. Bei runder Pupille und beschränktem Astigmatismus kommt es zu besserem Sehvermögen.

# Sinurespiratory Infections

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DURING the past ten years, intranasal insufflation of one-quarter to one-half per cent phenylephrine hydrochloride (Neo-synephrine) in physiologic solution of sodium chloride, preceded and followed by generally practised otolaryngologic measures, has been considered a most important part of my routine treatment of consecutive office patients with sinurespiratory infections. Children who object to other types of office treatment readily permit this insufflation.

Most other decongestants have been insufflated, with or without antibiotics. At times alternating negative pressure has been introduced. In the presence of irreversible chronic sinus or pulmonary infection, reasonable assurance of cure usually necessitates surgical intervention, since as all other measures, whether they involve insufflation, decongestion, dilution, displacement, or the use of chemotherapeutic or antibiotic agents locally, parenterally or orally, simultaneously or singly, or a change of residence to a more favorable climate, have rarely proved effective.

The insufflation apparatus is a nebulizer (Asthma Nefrin) with a thin ring of rubber tubing around its neck so that the individually sterilizable nozzle* may fit tightly. Oxygen or air under mild pressure is used for propulsion of the vapor.

The results are roentgenographically demonstrable; transillumination will show a hazy antrum lighting up after five to fifteen minutes of intranasal insufflation with a decongestant, and a dark antrum will often become lighter. This is of great prognostic significance. If the antrum remains black, either it is quite full of pus, or the ostium is blocked, or the membrane is so chronically thick that it cannot be decongested, or there is some other cause, such as tumefaction. Then if additional measures, such as displacement or trocar irrigations, have failed, the instillation of a contrast medium is indicated for further diagnostic roentgen study. Just as reversible sinusitis usually clears with ventilation and drainage, the respiratory tree, if it is simultaneously involved, benefits from this insufflation.

It is fortunate that the antrum, clinically observed to be a main source of purulent downward drainage into the lungs, is most amenable to treatment. Involvement of the other sinuses, however, especially the ethmoid as the site of origin or protraction of suppurative maxillary sinusitis, must not be overlooked.[1]

The late Lee Wallace Dean, in a personal conversation, stated that, in the old days before roentgen studies were possible, children with chronic productive cough were treated by irrigation of the antrums; or, on rare occasions, a minute triangular opening was made into the canine fossa to rule out or establish suppurative maxillary sinusitis, after which inferior meatal drainage was established as it is today when indicated.

Bronchographic study is desirable in the prognosis, as well as the choice of treatment, in any case in which a chronic productive cough is present. If the chronic cough is entirely associated with downward drainage from the sinuses and bronchographic study reveals no abnormality, al [illegible] the [illegible] is to be ex-

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*Becton & Dickinson, No. 2087.

From the Department of Otolaryngology, School of Medicine, St. Louis University.

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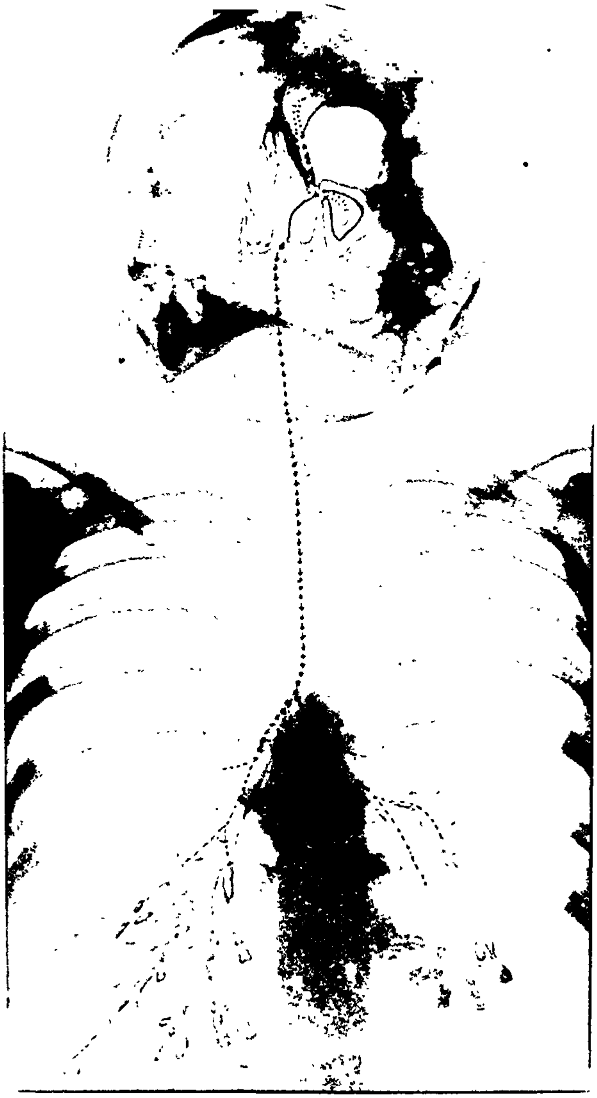
pected from adequate treatment directed to the sinuses. A typical case was that of L. S., a white man who was 37 when first seen. At the age of 27, after an attack of influenza, suppurative sinusitis developed. The acute signs and symptoms subsided, but a productive cough remained. Roentgen examination, including bronchographic studies, revealed no abnormality except an opaque right antrum. When irrigations of the right antrum repeatedly yielded distintegrating pus, a thick pyogenic membrane was operatively removed from within the right maxillary sinus. The downward drainage from the sinuses was stopped, and the patient became free of signs and symptoms.



Partially diagrammatic illustration showing condition of I. C., a white woman aged 37. Chronic left middle meatal suppuration was hidden behind obstructive septal deviation. Arrows indicate probable downward drainage from chronic suppurative left maxillary, anterior ethmoidal and frontal sinusitis. Associated bilateral bronchiectasis, productive of up to 1 quart of pus daily, were present.

In a one-year period (June 1944 through May 1945 BGH, Rome, Georgia) bronchographic studies were completed on 83 adults with cough. Of the 69 cases in which bronchograms showed no bronchiectasis, the condition in 22 was diagnosed as chronic bronchitis, in 38 as asthma and in 9 "miscellaneous." The other 14 of the 83 had bronchiectasis. Bronchitis itself was considered the cause of the bronchiectasis in 5 and asthmatic bronchitis in 4. The remaining 5 had associated sinusitis. As these studies indicate, common causes of chronic cough, without taking tuberculosis or cancer of the lung into consideration, are not only bronchitis and suppurative sinusitis but allergic disease, in which the so-called nonproductive cough results from prolonged, inordinate intake of common ingestants and/or excessive exposure to common inhalants. Frequently suppuration is superimposed upon allergy,[2] complicating the involvement of the sinuses and respiratory tract.

The medical treatment of chronic pulmonary suppuration is mainly palliative. Bronchiectasis usually is an indication for surgical treatment of the lung, if practicable, and if bronchiectasis coexists with or has been preceded by chronic suppurative sinusitis, surgical treatment of the sinuses is usually indicated. Many have seen patients with unrecognized chronic suppurative sinus disease in whom bronchiectasis existed, as in I. C. (see illustration), a white woman aged 37 when first examined. Her bronchial involvement dated back ten years. Severe bilateral bronchiectasis was productive of up to 1 quart of pus daily. Tuberculosis was ruled out. Left middle meatal suppuration was hidden by obstructive septal deviation. The latter was operatively corrected, and at the same time the pyogenic lining of the left antrum was removed, establishing inferior meatal drainage, and, as pus was still coming from the left middle meatus, the left anterior ethmoidal cells were exenterated. Recovery from the operation was uneventful. The frontal sinus cleared without any additional surgical procedure. The patient returned to her regular physician for further direction.

The aim is prevention of such chronic states, unresponsive to conservative therapy. Although acute sinurespiratory infections often subside spontaneously, adequate observation and treatment will insure complete resolution.

## CONCLUSIONS

An intranasally insufflated decongestant will enter the ostia and decongest the sinus membranes. Such insufflation is considered another efficacious procedure in the conservative management of acute or subacute exacerbations of chronic sinus infections and similar infections of the contiguous portions of the respiratory tract. Progress in the treatment of the sinuses may often be established by observing light transmission through the frequently involved maxillary sinuses.

Suppurative sinusitis and/or allergic disease must be suspected in any case of unexplained, protracted cough. If either is present, prompt alleviation will help to prevent pulmonary complications.

If protracted cough is entirely associated with downward drainage from the sinuses and bronchographic investigation reveals no abnormality, sustained efforts toward eradication of any existent suppurative sinusitis should afford complete clinical relief from sinurespiratory infection.

## CONCLUSIONES

La insuflación intranasal descongestiva entra por los ostium y descongestiona las membranas sinusales. Tal insuflación se considera otro procedimiento eficaz en el tratamiento conservador de las exacervaciones agudas ó subagudas de las infecciones crónicas sinusales e infecciones similares de las porciones contiguas al tracto respiratorio. El progreso en el tratamiento de los senos puede establecerse a menudo por la observación de la transmisión de luz a través de los senos maxilares frecuentemente complicados.

La sinusitis supurativa y/ó padecimiento alérgicos debe sospecharse en cualquier caso de tos persistente inexplicada. Si está presente, el alivio ayudará a prevenir complicaciones pulmonares.

Si la tos persistente se encuentra asociada con drenaje hacia abajo procedente de los senos y la investigación broncográfica no revela anormalidades, los esfuerzos sostenidos hacia la erradicación de cualquier sinusitis supurativa existente deben proporcionar alivio clínico completo de la infección sinusal respiratoria.

## CONCLUSIONI

I decongestionanti, insufflati per via endonasale, raggiungono le mucose dei seni attraverso gli orifici relativi, e rappresentano una efficace arma nella cura delle sinusiti croniche e riacutizzate e delle infezioni delle mucose respiratorie contigue.

Il miglioramento della sinusite può essere seguito mediante la transilluminazione del seno mascellare.

Quando ci si trova di fronte ad una tosse persistente e inspiegabile bisogna pensare alla sinusite purulenta e trattarla di conseguenza per prevenire le compli-

cazioni polmonari. Se la tosse è dovuta allo scolo di pus dai seni, e la broncografia è negativa, la cura della sinusite porterà alla guarigione anche dell'affezione respiratoria.

## RÉSUMÉ

L'insufflation dans les voies nasales d'un médicament décongestionnant les muqueuses des sinus, est considérée comme un bon traitement conservateur des sinusites chroniques ou aiguës, ainsi que des infections similaires de l'appareil respiratoire. Le traitement peut être amélioré par l'observation au moyen de la diaphanoscopie des sinus maxillaires qui sont aussi souvent contaminés par l'infection.

Il faut penser à une sinusite suppurée ou à une affection allergiue dans tous les cas de toux inexplicable. Dans ce cas, une atténuation rapide de l'infection contribuera à éviter les complications pulmonaires.

Lorsque la toux provient exclusivement de la sinusite et que l'examen pulmonaire ne révèle rien de particulier, tous les efforts doivent tendre à supprimer la suppuration des sinus, afin d'éviter une infection respiratoire.

## SCHLUSSFOLGERUNGEN

In die Nase eingeblasene Mittel, die zur Abschwellung der Nasenschleimhaut dienen sollen, dringen durch die Nasenöffnungen in die Nebenhöhlen ein und rufen eine Abschwellung ihrer Schleimhäute hervor. Derartige Einblasungen gehören zu den Verfahren, die als wirksam in der konservativen Behandlung akuter oder subakuter Exazerbationen chronischer Infektionen der Nebenhöhlen oder ähnlicher Infektionen der angrenzenden Teile des Atmungsapparates angesehen werden. Fortschritte in der Behandlung der Nebenhöhlen lassen sich oft durch Lichtdurchstrahlungen der häufig beteiligten Kieferhöhlen erzielen.

In allen Fällen von lange anhaltendem unerklärtem Husten soll man an die Möglichkeit einer eitrigen oder allergischen Nebenhöhlenerkrankung oder an eine Kombination von beidem denken. Liegt eine derartige Erkrankung vor, so kann man durch ihre rasche Beseitigung das Auftreten von Lungenkomplikationen verhindern.

Wenn ein hartnäckiger Husten durchwegs mit Ausfluss von den Nebenhöhlen einhergeht, und wenn die Bronchiographie keine krankhaften Veränderungen aufweist, kann erwartet werden, dass ernste Versuche zur Behebung einer eitrigen Nebenhöhlenentzündung zur völligen Heilung der Infektion der Nebenhöhlen und der oberen Luftwege führen.

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# Editorials

## Changing Trends in Wound Dressings

WHEN gauze dressings first were applied to wounds, their use stemmed from the necessity for controlling bleeding from unsutured wounds by pressure. Circumscribing bandages on the extremities and the abdomen become a necessary and common adjunct to the "disinfection" of wounds by boiling oil, phenol, wine or the hot iron cautery. Later, the extended use of sutures, the antisepsis of Lister, and the asepsis and hemostasis taught by Halsted focused attention more on accurate wound approximation and less on pressure. Nevertheless, heavy pressure dressings continued to find favor in a wide circle of adherents, presumably to prevent wound dehiscence and evisceration.

With the general use of immediate ambulation after celiotomy, which began in 1907, a sharp decline in the incidence of thrombophlebitis, phlebothrombosis, embolism pulmonary complications and wound infection was observed. This, coupled with the patent acceleration of wound healing, the decrease in acute retention of urine and adynamic ileus and the remarkable obtunding of postoperative pain, led an increasing number of surgeons to reevaluation of the benefits of this regimen. It is not strange, therefore, that patients themselves, naturally alert to their own comfort, called the attention of their surgeons to the discomfort of bulky dressings, not only during ambulation but during periods of rest. The adhesive taping, they pointed out, made traction on areas remote from the incision itself and made breathing painful, especially in view of repeated admonitions to breathe deeply. How often has one heard a patient, almost dyspneic from large dressings and wide adhesive strapping, implore the surgeon to loosen the bandage a little? And how seldom has enough temerity been mustered to hear the unconsciously physiologic plea?

During the past twenty-five years, however, a sufficient renewed interest in anatomic incisions and their closure with fine nonabsorbable sutures has developed, so that the thickness of the dressings, the extent of skin encompassed by them and the taping are now in inverse proportion to the vital capacity and comfort of the patients. In fact, South American surgeons were quick to detect the ancillary advantage of painting suture lines with thin Whitehead varnish and omitting further coverings altogether. This experience was gained from the treatment of scalp wounds, for which flexible collodion was for a long time the only dressing.

The use of flexible collodion over abdominal or thoracic incisions, therefore, with no other covering, is not new. A simple quick application of a thin flexible collodion solution in ether, fanned to dryness, is all that is necessary over gastrectomy, hysterectomy, herniorrhaphy or appendectomy incisions. That bulky dressings or massive adhesive taping do not contribute to the security of wounds will be admitted by every surgeon of broad experience. An infected incision, such as one made over an abscess or one through which a drain emerges, must be covered with a minimum of gauze dressing and sufficient adhesive tape to fix it to the skin.

The worn-out concept of wound immobilization by adhesive tape has gone the way of other outmoded surgical theories, such as that concerning the benefits of suppuration and of the resulting scar in the prevention of recurrent hernia. The briefest consideration of hernia development forces one to the conclusion that the skin does not prevent herniation; otherwise, inguinal hernia would not be present under a whole integument. Neither do snug, large dressings prevent hernia recurrence, and they certainly do not contribute to comfort.

Not the least important fact with regard to types of wound covering is that which directly interests the hospital administrator and, indirectly, but none the less certainly, the patient—the matter of dollars. The usual large celiotomy requires one or two large pads and several small gauze pads in addition to adhesive tape, at a total cost for materials alone of 70 or 80 cents for each dressing, even at hospital purchase prices. The operating room supervisor, who schedules as many as 15 large incisions in a day, may expend $300 monthly in dressings for these incisions alone, an astronomically different amount from the few cents required for flexible collodion.

CARROLL J. BELLIS, F.A.C.S., F.I.C.S.

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It is a strange thing how little in general people know about the sky. It is the part of creation in which nature has done more for the sake of pleasing man, more for the sole and evident purpose of talking to him and teaching him, than in any other of her works, and it is just the part in which we least attend to her. There are not many of her other works in which some more material or essential purpose than the mere pleasing of man is not answered by every part of their organization; but every essential purpose of the sky might, so far as we know, be answered if once in three days, or thereabouts, a great, ugly, black rain-cloud were brought up over the blue, and everything well watered, and so all left blue again till next time, with perhaps a film of morning and evening mist for dew. And instead of this there is not a moment of any day of our lives when nature is not producing scene after scene, picture after picture, glory after glory, and working still upon such exquisite and constant principles of the most perfect beauty that it is quite certain it is all done for us and intended for our perpetual pleasure. And every man, wherever placed, however far from other sources of interest or of beauty, has this doing for him constantly. The noblest scenes of the earth can be seen and known but by few; it is not intended that man should live always in the midst of them; he injures them by his presence, he ceases to feel them if he be always with them: but the sky is for all; bright as it is, it is not

Too bright or good
For human nature's daily food;

it is fitted in all its functions for the perpetual comfort and exalting of the heart, for soothing it and purifying it from its dross and dust. Sometimes gentle, sometimes capricious, sometimes awful, never the same for two moments together, almost human in its passions, almost spiritual in its tenderness, almost divine in its infinity, its appeal to what is immortal in us is as distinct as its ministry of chastisement or of blessing to what is mortal is essential. And yet we never attend to it, we never make it a subject of thought, but as it has to do with our animal sensations.

—*Ruskin*

# New Books

**Acute Renal Failure.** By Arthur Grollman. Monograph in the American Lectures Series in Internal Medicine. Springfield, Ill.: Charles C Thomas, Publisher, 1954.

The title of this monograph may be misleading, as it deals concisely but in ample detail with the causes of acute renal failure, including "lower nephron nephrosis," "tubulorhexis" and the "crush syndrome." The material is divided into etiologic factors, pathologic picture, clinical course and treatment of acute renal dysfunction. There is a comprehensive bibliography.

The vast experience of the author is indicated by the excellence of his discussion of the syndrome in each chapter and by his practical application of physiologic and chemical principles in maintenance of the volume, tonicity and composition of the body fluids. His explanation of the use of the artificial kidney and intermittent peritoneal lavage is particularly good.

The value of the monograph lies in its authoritative and concise handling of a not uncommon and serious condition. It should be in the library of every surgeon, gynecologist and urologist, as well as in that of the internist.

MELVIN L. AFREMOW, M.D.

**Modern Clinical Psychiatry.** By Arthur P. Noyes. Philadelphia: The W. B. Saunders Company, 1953. 4th ed. Pp. 609.

The new edition of this renowned textbook on psychiatry follows the new Standard Classification of mental disorders and personality disturbances, and allows a quick orientation in all diagnostic and therapeutic problems which the student of psychiatry may encounter. The psychologic as well as the biologic factors in the development of emotional and mental disorders are fully considered and wisely discussed; genetic and dynamic concepts are applied. Greater space is given to discussion of the principles of basic psychiatry, and these introductory chapters are very instructive and inspiring. Physical therapy, as well as psychotherapy, in its different forms of application, is aptly described.

ERNST HAASE, M.D.

**The Epilepsies: Electroclinical Correlations.** By Henri Gastaut. Springfield, Ill.: Charles C Thomas, Publisher, 1954. Pp. 149.

This excellent treatise gives a well organized, readable account of current clinical, neuropathologic and electrophysiologic knowledge about epilepsies. The author's approach is greatly influenced by the work and concepts of Wilder Penfield, to whom he dedicates his book, and whom he quotes in the preface: "Our problem today is that which was outlined for us by Hughling Jackson—to discover in each case the location of the origin of the discharge. It is possible to do this in a rapidly increasing proportion of cases." The essential problems are clearly presented and judiciously discussed. There are many interesting details in the description of the epileptic manifestations and also convincing experimental results, especially with intravenous injection of 5 per cent metrazol, which allows one to determine the individual myoclonic threshold and is also recommended to obtain a characteristic seizure recording when surgical intervention is contemplated.

With regard to the conservative treatment of epileptic patients, a good survey of the most common and most efficient anticonvulsives is given, obviously based on great personal experience. In cases of catamenial epilepsy reduction of fluid and salt before and during the menstruation is advised, and also administration of male hormones and progesterone. In cases of epilepsy with seizures on waking which may be influenced by a combination of low blood sugar and orthostatism, early intake of 30 to 50 Gm. of dextrose may be beneficial.

ERNST HAASE, M.D.

**Intratracheal Intubation in Anesthesia.** By Henri Gilbert. Paris: G. Doin et Cie, 1953. Pp. 190, with 39 illustrations.

This monograph describes clearly the anatomic structures of the respiratory tract, including the oral and nasal cavities, the pharynx, the larynx and the trachea, knowledge of which is important in endotracheal intubation. In addition, the work covers the most common abnormalities and pathologic changes that may create difficulty in intubation or even make it impossible. Dr. Gilbert stresses the value of indirect laryngoscopic study in preoperative examination, so that intubation may be safe, quick and nontraumatic. When nasal intubation is contemplated, examination of the nasal cavities and the epipharynx is essential.

A complete step-by-step description of the technic of direct and "blind" nasal intubation is presented, with emphasis on the dangers, difficulties and possible false routes, as well as the complications that may occur during or after the procedure. Separate chapters deal with the route of intubation, oral or nasal, the problem of aspiration, the technic of extubation and, briefly, the management of anesthesia induced by various agents in the intubated patient.

The author points out the absolute and relative indications for intubation, which depend on the presence of an emergency situation, the type of operation proposed and the requirements during anesthesia to insure safety for the patient and adequate working conditions for the surgeon. A brief review of the problems of respiration, together with a list of contraindications to intubation, concludes the book.

Dr. Gilbert has made a valuable contribution to the literature on intubation. The use of color plates rather than black and white would have improved the work.

H. CHIARI, M.D.

**The Technic of Surgical Procedures Involving the Sympathetic Nervous System, and Its Infiltration.** By O. Lamber, P. Razemon and P. DeCoulx. Paris: G. Doin et Cie, 1953. 4th ed., revised and enlarged. Pp. 256, with 115 illustrations and 4 color plates.

The new edition of this volume offers certain advantages: It permits the surgeon to search through the literature and observe, without unnecessary loss of time, the different technics of resection and infiltration of the sympathetic ganglia. The various technics and possible approaches to the sympathetic chain from the cervical to the sacral ganglia and the ganglia situated at the carotid bodies and the adrenal glands, as well as the splanchnic plexus, are described and clearly illustrated by many drawings.

This work brings the subject up to date. It is therefore a valuable contribution to modern surgical knowledge.

H. CHIARI, M.D.

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*Correction:* In the article "Cardiopericardiopexy" by Drs. Samuel A. Thompson and Levon A. Akopiantz, which appeared in the November issue of the *Journal,* Sections *A*, *B* and *C* of the illustration on Page 553 were accidentally dropped out of alignment and reproduced upside down. Correction of this error has been ordered for all reprints of the article, with the inclusion of some slight statistical additions to the article itself, recently sent us by Dr. Thompson. The Editorial Staff extends sincere apologies to Drs. Thompson and Akopiantz, as well as to all readers, for the inadvertent reversal of the cuts.

**Carcinoma of the Breast: A Surgical Follow-Up Study.** Boyd, A. K., Enterline, H. T and Donald, J. G., Surg., Gynec. & Obst. 99: 9, 1954.

All cases of carcinoma of the breast treated at the hospital of the University of Pennsylvania during the twenty-year period ending in 1943 were included in this study. The 1,034 cases were classified as primary (870 cases) and secondary (227 cases), depending upon whether the patient had been previously treated elsewhere for the same disease.

Nine hundred and seventy-five, or 94.3 per cent, discovered the lesions themselves. It appears, therefore, that early detection of mammary cancer still depends primarily upon public instruction in periodic self-examination.

The studies by five-year periods of the interval between onset of the first symptoms of carcinoma and admission to the hospital indicate an encouraging, if slow, improvement.

The fact that there were 18 patients under 30 years of age (1.7 per cent) agrees well with the 2 per cent incidence reported by deCholnoky. The authors' statistics agree with previous authoritative reports that carcinoma in the young apparently affords no worse a prognosis than in any other age group.

Radical mastectomy was the procedure of choice unless it was considered too hazardous or impossible of execution. In this series there was 1 operative death in 417 radical mastectomies.

The strict operability criteria of Haagensen and Stout were somewhat extended, and patients were subjected to radical mastectomy when the operation seemed to offer a reasonable chance of cure or satisfactory palliation.

Simple mastectomy in earlier stages of the disease has failed to produce results equal to those of radical mastectomy. This conclusion is fortified by the observation of Geschickter that in cases of mammary cancer 10 to 15 mm. in diameter, with symptoms present for an average of three months, axillary metastases in 43.8 per cent of patients per cent. Haagensen and Stout reported axillary metastases in [illegible] per cent of patients with primary mammary lesions less than 20 mm. in diameter.

Detailed study of the pathologic features in each case indicated again that papillary, [illegible] intraductal and colloid carcinomas of the breast offer a much better prognosis than the general run of carcinomas in this [illegible]. Microscopic involvement of the skin and invasion of the axillary fat from involved lymph nodes seemed not to change the prognosis.

THOMAS WILENSKY, M.D.

**The Surgical Significance of Regional Lymphatic Drainage of the Hepatic Flexure.** Phillips, J. W.; Waugh, J. M., and Docherty, M. B., Surg., Gynec. & Obst. 99:455, 1954.

The complete removal of a lymphatic chain for a lesion of the hepatic flexure has long been a controversial subject. One school of thought advocates its removal, with sacrifice of the entire middle colic artery. Another group maintains that this radical procedure might compromise the circulation to the rest of the colon and jeopardize the integrity of the intestine. Evidence is rapidly accumulating that the entire middle colic artery can be abolished without disturbance of the anastomosis. It is obvious that extirpation of the entire artery may facilitate more radical removal of all of the lymph nodes in this area, with an increment of the curative margin. Since the lymphatic chains in this area follow their respective vessels, the authors have adopted the following nomenclature: (1) inferior mesenteric chain; (2) left colic chain; and (3) ileocolic chain, epicolic, paracolic and intermediate chain.

Nine patients were accepted as suitable candidates for removal of the entire middle colic artery for carcinoma of the hepatic flexure. Having obtained the specimens, in which a detectable dye had been injected during exploration, the authors submitted them to a rigid study by the surgical pathology laboratory. In 7 specimens the dye was taken up by the middle col[illegible] nel only and did not ap[illegible] or the right colic lymphat[illegible] ninth specimens [illegible] multiple channe[illegible]

Ninety-eight lymph nodes were examined in the 9 specimens, 5 of which showed grade 2 adenocarcinoma. Two specimens each were of Grades 1 and 3 respectively. A metastatic node was observed adjacent to the origin of the middle colic artery. Had the resection fallen short of this nodal involvement, this patient might have had an early recurrence of the tumor.

The following comments are made: 1. The main group of middle colic nodes is situated near or at the origin of middle colic artery. 2. Resection of only the right branch of the middle colic artery is inadequate for complete extirpation of the middle colic lymph chain. 3. Stewart and Rankin found the middle colic artery absent in 4 per cent of cases and observed that an accessory middle colic artery supplied the transverse colon and splenic flexure in 37 per cent. 4. In 10 per cent of cases an accessory middle colic artery arises from the superior mesenteric artery.

In keeping with the tenets of adequate cancer surgery it becomes mandatory, when asible, to ligate the middle colic artery ith its concomitant nodes and to remove e epicolic, paracolic and intermediate roups.

S. L. GOVERNALE, M.D.

**Endocrine Origin of Premature Spontaneous Interruption of Pregnancy. Cytological Test for Progress and Control of Treatment. Outline of Therapy** (Interruption prématurée spontanée de la grossesse d'origine endocrinienne. Test cytologique de l'évolution et de controle du traitement. Conduite du traitement). Merger, R.; Levy, J.; Bejat, G., and Melchior, J., Presse Med. 62: 925, 1954.

The object of this paper is to present a critical comparison of the available biochemical tests for abortion, to study the cytologic criteria and to outline a course of rational treatment in cases of "endocrine abortion."

In the authors' opinion, the best biologic test for the control of abortion of endocrine origin is the cytologic and not the biochemical method. The cytologic test, as outlined by Pundel and Van Meensel of Belgium, consists of preparing a smear from the posterior fornix of the vagina of the pregnant woman suspected of being in danger of abortion due to endocrine imbalance. Staining is done by the Shorr-Harris differentiation method.

In cases of imminent abortion the smears show the following changes: marked eosinophilia of the superficial cells, scarcity or absence of navicular cells, extreme scarcity of basophils, and the presence of polymorphonuclears and sometimes even red erythrocytes. These changes occur very early, and their detection points to immediate treatment.

Therapy is mainly by diethyl-stilbestrol, which the authors administer in relatively large doses according to whether abortion is suspected, habitual or imminent. In cases of resistance a combination of estrogen and progesterone is used. Frequent cytologic control tests are done, and treatment is altered accordingly. When the smears have returned to normal the danger of abortion can be considered averted.

It is pointed out that the smears should be interpreted by a qualified cytologist. Trichomonas vaginalis and moniliasis invalidate the readings.

This study is based on 52 cases, and 3 case histories are included as examples.

S. A. GUEUKDJIAN, M.D.

**The Curability of Stomach Cancer.** Mason, E., J. Iowa State Med. Soc. 44:150, 1954.

Mason expresses the opinion that the "unwarranted attitude of pessimism" held toward gastric cancer by some surgeons of experience and authority can be refuted only by obtaining unequivocal evidence of the effect of early diagnosis on the cure rate. He is convinced that a satisfactory study of the effects of actual early diagnosis on the survival rate has not yet been made. A control series of actual "early cases" would necessarily be gathered by screening asymptomatic and unselected members of the general population. In such a group one would expect 100 per cent operability and a considerable improvement over the current 40 per cent resectability for cure. The all-important five year follow-up and its comparison with the current five-year survival rates should produce some significant observations.

It remains exceedingly important that physicians maintain a special alertness to this disease and its vague early symptoms if a decrease in delay of treatment is to be realized.

THOMAS WILENSKY, M.D.

**Pancreaticoduodenal Resection.** Morel, E L.; Janzen, J., and Carter, J., Am. J. Gastroenterol. 21:435, 1954.

The authors briefly review the factors concerned in this type of radical operation, including the physiologic effects of total pancreatectomy. The review is studied under four headings:

1. The end results and long-term prognosis following pancreaticoduodenectomy.
2. The early diagnosis of suitable cases in which pancreaticoduodenectomy may offer a curative surgical treatment.
3. The proper selection of patients on whom this rather formidable procedure may be performed.
4. The physiologic changes produced by the operation.

In a review of the mortality rate, it is observed that this has decreased with greater experience of these radical procedures. Early surgical exploration of patients with obstructive jaundice is urged, with a view to saving these hitherto hopeless patients.

LYON H. APPLEBY, M.D.

**The Repercussion of Pancreatic Disease on the Spleen (Le retentissement splénique des affections pancréatiques).** Leger, L., Lajouanine, P.; Cornet, A., and Arnavielhe, J., Presse Med. 62:666, 1954.

The intimate anatomic relation between the splenic vein and the tail of the pancreas explains the frequent involvement of the spleen and its vascular system in diseases of the pancreas. Symptoms of such secondary involvement either follow the primary pancreatic disease or appear first, before any suspicion is directed toward the pancreas. Radiologic splenoportographic investigation gives valuable information in such cases.

One group of observations deals with cases of carcinoma of the pancreas with posterior extension causing compression or thrombosis of the splenic vein. The strange symptoms could be elucidated only by splenoportographic study.

It is usually not realized that splenomegaly is a common sequel to carcinoma of the pancreas—up to 25 per cent of cases, according to some writers (Duff). A case is recorded in which enlargement of the spleen was considered primary until further investigation revealed it as secondary to a carcinoma of the pancreas.

An altogether different disease due to secondary splenoportal involvement is hemorrhage from the gastrointestinal tract due to portal hypertension following pancreatic disease, causing compression. In certain cases such syndromes as Banti's disease may be simulated.

Besides being of clinical diagnostic interest, splenoportographic study can be a guide in surgical procedures. Done preoperatively, it can inform the surgeon as to the operability or nonoperability of a tumor of the pancreas.

Personal case records and excellent roentgen reproductions enrich this well-written paper.

S. A. GUEUKDJIAN, M.D.

**Benign and Precancerous Lesions of the Breast.** Fleming, R. M., and Drosd, R. E., Southern M. J. 47:922, 1954.

Mammary dysplasia, such as cystic mastitis, according to Geschickter, can be envisaged as the precurser of cancer. On the other hand, Stout has maintained that precancerous lesions do not exist; a lesion is either benign or malignant from the beginning.

The authors have examined 2,000 women in the past ten years and have arrived at certain conclusions of their own. Out of this number, 1,120 had diseases referable to the breast. Further breakdown revealed that 159 of the 1,120 had cancer of the breast. Mastodynia was present in 96 cases; fibroadenoma in 61; fibrocystic disease of the breast in 438; intraductal papilloma in 14, and miscellaneous conditions in 316.

Among the women with fibrocystic diseases (39 per cent) the peak of incidence was in the premenopausal period (ages 40 to 50). Eighty, or 32 per cent, had pain and tenderness. Intraductal papilloma occurred at about the same age; its incidence, however, was only 3.2 per cent. Bleeding from the nipple was commonly observed.

Surgical exploration is wise, and much of the surgical therapy depends on what a good pathologist finds. The authors recommend aspiration of all fibrocystic lesions of the breast as well as of the Schimmelbusch type of lesion. The fluid is cytologically examined, and if benignity is assured no other form of treatment is advised unless the cyst recurs. Recurrence warrants surgical exploration.

GOVERNALE, M.D.

**An Interim Report upon the Second Look Procedure for Cancer of the Stomach, Colon and Rectum and for Limited Intraperitoneal Carcinosis.** Wangensteen, O. H.; Lewis, F. J.; Arhelger, S. W.; Muller, J. J., and MacLean, L. D., Surg., Gynec. & Obst. 99:257, 1954.

The theory of the "second look" procedure is discussed in this article. After extensive primary operations have been performed, the authors relaparotomize the patient and search for recurrences of cancer that have not given rise to symptoms. This is not limited to one second look but to third, fourth and even more looks. The operating does not cease until examination gives completely negative results. Instances are cited in which lymph nodes were found containing malignant tissue. These have been excised and further operations performed. This type of surgical treatment is discussed in relation to cancer of the stomach, colon and rectum, as are reoperating on patients with advanced intra-abdominal cancer not completely removed at the original exploratory operation.

Case histories are cited in support of the procedure; one is that of a patient on whom one original operation and five reoperations were performed. Tables are included for the series operated on, and diagrams explaining the surgical technic are included. A strong case is made for this hitherto unorthodox treatment, and figures are cited in its support.

LYON H. APPLEBY, M.D.

**Fifty Large Incisional Herniae Treated by F. Langenskiold's Operation.** Langenskiold, A., Acta Chir. Scandinav. 106:417, 1954.

This method for the repair of large incisional hernias was introduced in 1943 and soon demonstrated its superiority over standard technics, even when latent infection in the scar tissue was reactivated.

F. Langenskiold's operation is an improvement, because most of the tension between the hernial margins is carried by the tissues themselves rather than by the sutures. This purpose is accomplished by utilizing the subcutaneous hernial sac or scar plate for the creation of a number of strips about 2 cm. wide, which are detached at one end, alternating between right and left, and are then drawn through holes about 2 cm. from the opposite margin of the hernial orifice.

When tightened, the margins of the defect can be approximated with sutures. The strips are then folded back and sutured down, or they can be tied and the ends sutured to the fascia.

For 50 large ventral hernias which constitute the basis for this report, closure in layers in the usual way would have been impossible or extremely difficult. The operations were performed at 9 hospitals and by 18 surgeons, without a death, although in 29 out of 50 operations more or less extensive intra-abdominal adhesions were observed, and in 3 cases the intestine was perforated at operation.

Infection of the operative wound with suppuration and sinuses occurred in 24 cases.

Of the 44 patients subjected to satisfactory followup examination, 7 had recurrent hernia. Most of these recurrences were minimal and were due to failure of the operation to cover a sufficiently large area.

The reported high incidence of recurrence following operation on small incisional hernias seems to indicate that special methods should be applied in the repair of these too, instead of the usual closure in layers.

In exceptional cases this method can be performed in two stages, so that it is seldom necessary to implant fascia or foreign bodies.

THOMAS WILENSKY, M.D.

**A Surgeon's Classification of Carcinoma of the Stomach.** Hoerr, S. O., Surg., Gynec. & Obst. 99:291, 1954.

A practical classification for malignant disease of the stomach is suggested. The method is similar to that put forward some years ago by Cuthbert Dukes of London for classification of carcinoma of the rectum.

Two factors are taken into consideration: the extent of metastases, which are classified into three stages, A, B, and C, and the degree of invasion or local extension in the stomach itself, designated by numerals I, II, and III. The letters and numerals are then combined and are used for the purpose of prognosis. The types of lesions are clearly shown in accompanying diagrams. A personal series of 100 patients with carcinoma of the stomach is classified and presented for study. No attempt is made to take into account the histologic appearance of the tumor.

LYON H. APPLEBY, M.D.

**Mitral Valvotomy in Pregnancy.** Crawshaw, G. R.; Van der Spuy, J. C., and Wilson, V. H., South African M. J. 28:496, 1954.

It was formerly the practice to discourage childbearing in case of organic heart disease or, if pregnancy were already established, to advise its termination.

The need for a modification of views on the treatment of such patients in the light of successful surgical relief of mitral stenosis has been pointed out by Baker and others. Termination of pregnancy on the grounds of stenosis alone cannot be justified until the exact state of the mitral valve is revealed. Three cases have been reported by Baker and his associates in which mitral valvotomy was successfully performed during pregnancy and the patients had normal deliveries at term. Logan and Turner also reported valvotomies in 3 pregnant women in whom pregnancy continued uneventfully.

*Risks of Pregnancy with Rheumatic Heart Disease.* — Cardiac diagnostic problems of pregnancy are principally those of rheumatic heart disease. The total mortality rate in a large group of well-cared-for women with rheumatic heart disease was given by Morgan Jones as 4.8 per cent, but he pointed out that the yearly death rate for nonpregnant women with rheumatic heart disease between 20 and 40 years of age is variously reported as between 2 per cent and 6.7 per cent.

Pulmonary edema in cases of rheumatic heart disease is one of the most frequent symptoms. Auricular fibrillation and, subsequently, right ventricular failure, with systemic venous engorgement and dependent edema, are present.

Failure of the right side of the heart, with regular rhythm, is by no means uncommon during pregnancy.

Fatal pulmonary emboli may follow the termination of pregnancy, and when termination is undertaken on account of the cardiac lesion, death, in the author's opinion, must be attributed to the association of heart disease with pregnancy, although indirectly. The author uses three classifications in grading:

*Group I:* Patients with no symptoms during active pregnancy and minimal roentgenographic cardiac enlargement.

*Group II:* Patients with symptoms during ordinary activity before pregnancy, moderate roentgen cardiac enlargement or definite roentgen pulmonary congestion, but no failure of the right side of the heart, or paroxysmal dyspnea.

*Group III:* Patients with severe symptoms on slight activity before pregnancy, with present or past heart failure, paroxysmal dyspnea,, severe repeated hemoptyses or auricular fibrillation.

The mortality rate cited by Morgan-Jones found in these three groups was less than 1 per cent in Group I, about 5 percent in Group II and more than 10 per cent in Group III. He states that a patient in Group I, if already pregnant, should have a normal pregnancy under cardiac supervision, with hospital delivery. A patient in Group II should be allowed to have a normal pregnancy under cardiac supervision, with delivery in the hospital and the second stage of labor shortened by low forceps. The pregnancy of a patient in Group III should be terminated if it is early, but in the later months it is safer to allow it to go to term.

*Mitral Valvotomy.* — Mitral valvotomy in patients between 15 and 45 years carries a low mortality rate. In a series of 106 consecutive operations observed by the authors there were 4 deaths. The author states that 12 patients who were pregnant and who also suffered from mitral stenosis have undergone operations. The major indication for operation was pulmonary edema or hemoptysis, and 3 of the patients were *in extremis* when admitted. The author states that the outstanding feature of this series of operations was the smoothness of the postoperative convalescence and the way in which the remaining period of pregnancy in most cases progressed. He states that the indications for valvotomy might be grouped under two headings: emergency (the procedure is often life-saving when the patient is suffering from pulmonary edema) and elective. He states that elective operation could theoretically be advised either during prgnancy, after delivery or after termination. In his conclusions he suggests that there is no more reason to assess a pregnant woman for mitral valvotomy than to judge a nonpregnant woman in the same manner. The ultimate results of mitral valvotomy are still in doubt, particularly as regards long-term results. There can be no doubt of the immediate benefit obtained from valvotomy when mitral stenosis complicates pregnancy.

It is further stated that pregnancy in a woman with mitral stenosis is an added indication for valvotomy, because of the peculiar danger of pulmonary edema when these two conditions are [illegible]

M.D

**Backache and the Disc.** Rose, G. K., Lancet 1:1143, 1954.

This timely article is a readable and instructive summation of the author's efforts to sift the immense volume of fact, hypothesis and fiction that has accumulated since the intervertebral disc was "discovered" some twenty years ago by Mixter and Barr.

Rose emphasizes the importance of recognizing the fact that retrogression starts in the disc at about 18 years of age and that the annulus fibrosis in almost every instance begins to show degenerative changes in the third decade of life.

Acute prolapse can take place only during a relatively short period, when the annulus has not yet degenerated to any great extent but is slightly less efficient than the nucleus in the hydrodynamic state. Bulging of the whole disc posteriorly, and even its sequestration into the spinal canal, can occur later in life, particularly in the cervical region, but acute nuclear prolapse never does.

Important also is the observation that the whole disc can degenerate quietly, without any sterior prolapse, as a result of some trauma of prolapse through the cartilaginous plate.

In every instance of backache, sciatica or brachial neuritis the phenomena presented must be explored in an orderly, sensitive and patient fashion. A rational basis for the treatment of backache can be achieved in no other manner.

The pain of muscle spasm is often severe and of sudden onset. Its relief may be equally sudden and may follow some manipulative procedure. When manipulation, whether imposed deliberately or accidentally sustained, results in dramatic relief of pain, it is more than likely that one is dealing with a lesion of the intervertebral articulation, for loose bodies are not uncommon here, particularly in the middle-aged.

It is still strongly disputed whether pressure on a nerve root causes pain; likewise, the very characteristic but inconstant sciatic radiation of pain on coughing or sneezing has not been satisfactorily explained.

Sclerotogenous pain is characteristically slow, deep, aching and accompanied occasionally by constitutional disturbances causing more or less subjective uselessness to the part. It is accompanied by local tender spots situated at the insertions of tendons. The richest distributions of afferent areas are in the posterior longitudinal ligament of the spinal cord, the annuli, the dura and (probably) the capsules of the intervertebral articulations.

Many patients with coccygodynia have this area of referred tenderness in the second sacral sclerotome. Similarly, the commonly encountered tender area in relation to the posterior superior spine has given rise to the sacroiliac cult.

Pain undoubtedly arises from the intervertebral joints, which are deranged by diminution of the disc space. Loose bodies occur, and osteoarthritic changes are common.

Skeletal derangement in the cervical area by interference with head position and balanc may give rise to vertigo and even secondary nausea, constituting the posterior cervical syndrome of Barré.

An intimate experience with the prolapsed intervertebral disc at operation suggests that permanent reduction of the prolapsed nucleus pulposus must be quite rare.

Falconer (1948) has shown that when a prolapsed disc is demonstrable by myelogram in an acute phase, conservative treatment with complete clinical recovery apparently does not change the disc in any way, according to a later myelogram. In 1 such case, at operation, the nerve root was lying loosely over a large prolapse. Conservative treatment is most likely to fail when the disc is prolapsed laterally, when the related nerve root is confined to a bony passage and when its dural covering is tough and anchored.

In the great majority of cases conservative treatment is successful when applied systematically and with due recognition of the associated skeletal derangement.

Treatment of the skeletal derangement is of paramount importance and differs according to the site. In the lumbar region, where the prime function is that of transmission of strong forces, the primary line of treatment must be based on support. Immobilization, both efficient and prolonged, will permit healing of the intrinsic lesion, in addition to giving symptomatic relief. The merits of each case will determine the length of time for which the plaster spica, or corset, canvas belt or brace must be worn. In many patients the lumbosacral belt can be discarded after a further six to twelve months in the assurance that the symptoms are relieved and that the intrinsic lesion is healed. Some patients, because of physical or psychological inadequacy, must wear such belts for the rest of their lives.

# THE JOURNAL OF THE INTERNATIONAL COLLEGE OF SURGEONS

Index, Volume XXII, July-December, 1954

By Subjects and Authors

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## INDEX TO ARTICLES

Abortion
  habitual .................. 208
Abstracts
  August .................. 226
  September (Argentine) .................. 325
  October .................. 496
  November .................. 627
  December .................. 751
Anesthesia
  for brain surgery .................. 557
  of inferior alveolar nerve .................. 85
  spinal, impending death under .................. 134
Angioma
  cerebral venous .................. 94
Anomaly
  of urinary tract .................. 261
Appendicitis
  acute, incidence of .................. 456
Arachnoiditis .................. 18
Artery
  coronary, insufficiency of .................. 503
  internal mammary, as implant .................. 503
Atresia
  of posterior nares .................. 447
Avulsion
  of central third of face .................. 228

Bile
  restoration of flow .................. 243
Bile duct, common .................. 150
Biliary channels
  lithiasis of .................. 664
Bladder
  disturbances of .................. 61
Blood
  extracorporal circulation of .................. 107
Bones
  measurement of .................. 208
Book reviews
  July
    Ingraham, F. D., and Matson, D. D.: *Neurosurgery of Infancy and Childhood* .................. 105
    De Palma, A.: *Clinical Orthopaedis.* 105
    Rigler, L.: *The Chest* .................. 105
  August
    Risholm, L.: *Studies on Renal Colic and Its Treatment by Posterior Splanchnic Block* .................. 223
    Illingworth, C. F. W.: *Peptic Ulcer.* 223
    Konjetzny, G. E.: *Mastopathie und Milchdrusenkrebs* .................. 223
    Gilbert, H.: *Intratracheal Intubation in Anesthesia* .................. 224
    Pulaski, E. J.: *Surgical Infections* .................. 225
    Edwards, J. E.; Dry, T. J.; Parker, R. L.; Burchell, H. B.; Wood, E. H., and Bulbulian, A. H.: *An Atlas of Congenital Anomalies of the Heart and Great Vessels* .................. 225
  October
    Riveros M., M.: Cancer: *Problemas Clinico-terapeuticos* .................. 494
    Palumbo, L. T.: *Low Back Pain and Sciatica* .................. 494
    Bauer, L. H.: *Seventy-Five Years of Medical Progress* .................. 494
    Ameline, A.; Huguier, J.; Moyse, P., and Chatain, Y.: *La Chirurgie a Deux Equipes dans le Traintement des Cancers Pelviens* .................. 495
  November
    Levitt, T.: *The Thyroid* .................. 625
    Laborit, H.: *Resistance et Soumission en Physio-biologie: L'hibernation Artificielle* .................. 625

December
  Gastaut, H.: *The Epilepsies: Electro-clinical Correlations* ............ 749
  Gilbert, Henri: *Intratracheal Intubation in Anesthesia*.............. 740
  Grollman, Arthur: *Acute Renal Failure* ......................... 749
  Lamber, O., Razemon, P., and DeCouix, P.: *The Technique of Surgical Procedures Involving the Sympathetic Nervous System and Its Infiltration* ................ 750
Brain
  tumors of ...................68, 94, 98

Carcinoma
  in situ ............................ 426
  of uterine cervix ................... 438
  of jejunum ......................... 229
  of penis ........................... 711
  of thyroid ......................... 408
Cardiopericardiopexy .................. 531
Cartilage
  diced .............................. 283
  semilunar knee ..................... 473
Cataract
  axis traction extraction of............ 737
Catgut
  allergenic tissue reaction of......... 707
Cavernoma
  venous ............................. 401
Cervix, uterine
  carcinoma of ....................... 438
  lacerations of ..................... 433
  lesions of ......................... 643
Colectomy
  total .............................. 425
Cord, spinal
  experimental regeneration of........ 66
  reflexes of ........................ 30
Cyst
  echinococcus, spinal ............... 36
  pilonidal .......................... 181
Cystectomy, radical ................... 723

Death
  impending, under spinal anesthesia... 134
Diagnosis
  of lesions of cervix................ 643
Diastematomyelia ...................... 100
Disc, lumbar
  degeneration of .................... 375
Dislocation
  congenital, of hip ................. 211
Disorders
  spinal, congenital ................. 59
Drainage
  surgical ........................... 683
Duct
  common bile, relation of head of pancreas ......................... 150
Ductus arteriosus
  potency of ......................... 714

Ear
  plastic reconstruction of............ 473
Echinococcosis
  spinal ............................. 35
Editorials
  July
    *Section on Neurosurgery: A New Field of Cooperative Endeavor*... 103
  August
    *The Use of the Cobalt* 60 *Unit*...... 219
  September
    *An Evaluation of the Surgical Approach to the Duodenal Ulcer Problem* ...................... 320
  October
    *Semmelweis and the Struggle for Truth* ......................... 489
  November
    *A New International Service*....... 622
  December
    *Changing Trends in Wound Dressings* 747
Electrocoagulator
  bipolar, for hemostasis ............. 733
Esophagoplasty
  extrathoracic ...................... 118
Esophagus
  surgical treatment of ............... 253
Examination
  discographic ....................... 76
Eye
  indications for operation............ 614

Face
  avulsion of ........................ 247
Fibrillation
  of ventricle ....................... 265
Fibula
  venous cavernoma of................. 401
Fistula
  anorectal .......................... 607
  intestinal ......................... 278
  tracheoesophageal .................. 391
Flap
  bone ............................... 463
  plastic ............................ 181
Foramen magnum
  tumors of .......................... 1
Frame
  for splinting hip .................. 211
Fusion
  of vertebral body................... 375

- Graft
  - alloplastic bone .................... 238
  - diced cartilage .................... 283

- Hashimoto's disease .................. 726
- Head
  - carcinoma of
- Hematoma
  - of rectus abdominis................ 519
- Hemostasis ........................ 733
- Hip
  - congenital dislocation of ........... 211
- Hysterectomy
  - total abdominal .................... 299

- Implant
  - internal mammary artery............ 503
- Indications
  - for eye surgery ................... 614
- Infants
  - suffocation of ..................... 447
- Infection
  - sinurespiratory .................... 743
- Instrument
  - for phlebodissection ............... 487
  - for electrocoagulation ............. 733
- Insufficiency
  - of coronary artery ................ 503
- Intestine
  - suturing and plication of........... 174
- Ischemia
  - myocardial ....................... 551

- Jejunum
  - carcinoma of ...................... 229
- Joint, sacroiliac
  - shearing injury to................. 631

- Kidney
  - polycystic ........................ 673

- Lacerations
  - of uterine cervix.................. 208
- Lingula
  - pancreatic ........................ 107
- Lithiasis
  - of biliary channels ................ 664
- Liver
  - surgical treatment of .............. 542
- Lupus erythematosus ............... 204

- Massage
  - cardiac ........................... 535
- Mechanism
  - of spinal shock..................... 44
- Muscle
  - rectus abdominis, hematoma of...... 519

- Musculature
  - anorectal, surgical significance of.... 367
- Myocardium
  - ischemia of ........................ 551

- Neomycin
  - in preparation for intestinal surgery. 602
- Nephrectomy
  - partial, for tuberculosis............. 477
- Nonunion
  - of navicular bone .................. 459

- Occlusion
  - mesenteric vascular ............... 578
- Operation
  - intestinal, preparation for.......... 602

- Palate, cleft
  - repair of .......................... 468
  - Pancreas
    - annular ........................ 414
    - cystadenocarcinoma of ........... 440
    - lingula of ...................... 150
- Paraganglioma
  - malignant ......................... 656
- Paraplegia
  - spasticity in ...................... 53
- Plication
  - of intestine ....................... 174
- Pneumothorax
  - extrapleural ....................... 190
- Pregnancy
  - ovarian .......................... 204
- Problems
  - urologic ......................371, 583
    - medicolegal ...................... 583
    - of interest to general surgeon...... 371
- Prolapse
  - rectal ............................ 202
- Prosthesis
  - vitallium sphere .................. 459

- Rectum
  - prolapse of ....................... 202
- Regeneration
  - experimental, of spine............... 66
- Rehabilitation
  - of spastic patients................. 200
- Rupture
  - cardiac, during massage............ 535

- Shock
  - electric, for ventricular fibrillation.... 265
  - spinal, mechanisms of .............. 44
- Shoulder
  - painful, stiff ...................... 695

Hagbarth, Karl-Erik .................. 30
Haigler, Samuel H...................... 656
Hall, William E. R...................... 570
Hansen, A. M........................... 643
Healey, John E. ...................... 542

Jennings, Mary H. ......................643

Kammerling, E. M. .................. 204
Karavitis, Andrew L. ................ 68
Katsura, Shigetsu .................. 253
Knapp, Arthur Alexander............. 622
Kobrak, H. G........................... 214

Ladin, Philip ........................ 598
Lalor, Thomas J. .................... 151
Lazorthes, G. ........................ 557
Letac, Roger ........................ 649
Lewis, Carl .........................
Lichtor, Alexander ................. 238
Lithgow, Charles H. ................ 299
Love, J. Grafton....................... 1

Mammãna, Caetano Zamitti........... 664
Mann, Lawrence S. ..............456, 602
Mascati, Naumann T. ................ 312
Mason, Lorne A. ..................... 440
Mathá, Charles Pierre ............... 673
Matson, Donald ..................... 59
McCrea, Lowrain E. ................. 261
McCouch, Grayson P. ............... 44
McCurrich, H. J. .................... 243
McGrath, F. L. ........................ 440
Metcalfe, John W. .................... 459
Morani, Alma Dea ................... 247
Moore, William James................ 594
Morton, James A. .................... 100
Mozes, Mark ......................... 278
Nikishin, Igor F. ..................... 535
Noble, Thomas B. .................... 174
von Novak, E. ........................ 115
Noyes, Marion B. ..................... 299
Nugent, Oscar B. ..................... 737

Orbach, Egmont G...................... 707

Peer, Lyndon A. ..................283, 468
Perl, John I. ........................... 76
Puigvert, A. ........................... 477
Pujadas, Guillermo M. ............... 308

Ritter, Saul Alfred...................... 401
Roberts, Morton ...................... 726
Ross, Stuart T. ........................ 607
Rosner, Samuel ......................94, 98

Sakakibara, Shigeru ................. 265
Scheck, Max ........................... 211
Schumer, William ..................... 602
Scuderi, Carlo ........................ 733
Skapinker, Samuel .................... 414
Smanio, Triests ....................... 150
Spaulding, George E. ................ 299
Steinberg, Werner .................... 208
Svien, Hendrick J. .................... 68

Tezelli, Sacid ......................... 190
Thelen, Emil P. ........................ 1
Thompson, Samuel A. ................. 551
Thorek, Max ...............134, 229, 519
Tomusk, August ....................... 602
Trace, Herbert D. ..................... 614
Turek, Samuel L. ...................... 695
Turner, S. J. ........................... 204

Vakil, Rustun Jol ...................... 714
Vernon, Sidney ......................... 723
Vertuno, John W. ...................... 737
Vineberg, Arthur ...................... 503

Watson, T. A. .......................... 219
Watts, James Winston................. 103
Weinstein, Mandel ..................... 726
Wershub, Leonard Paul............... 594
Williams, Jonathan M. ................ 18
Wood, Clarence L. ..................... 673